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Dairy Goats Breeding/Feeding/Management

Michigan State University Extension Service

Byron E. Colby, David A. Evans, Dr. Sidney J. Lyford, Dr. William B. Nutting, Douglas N. Stern, D.V.M., University of Massachusetts

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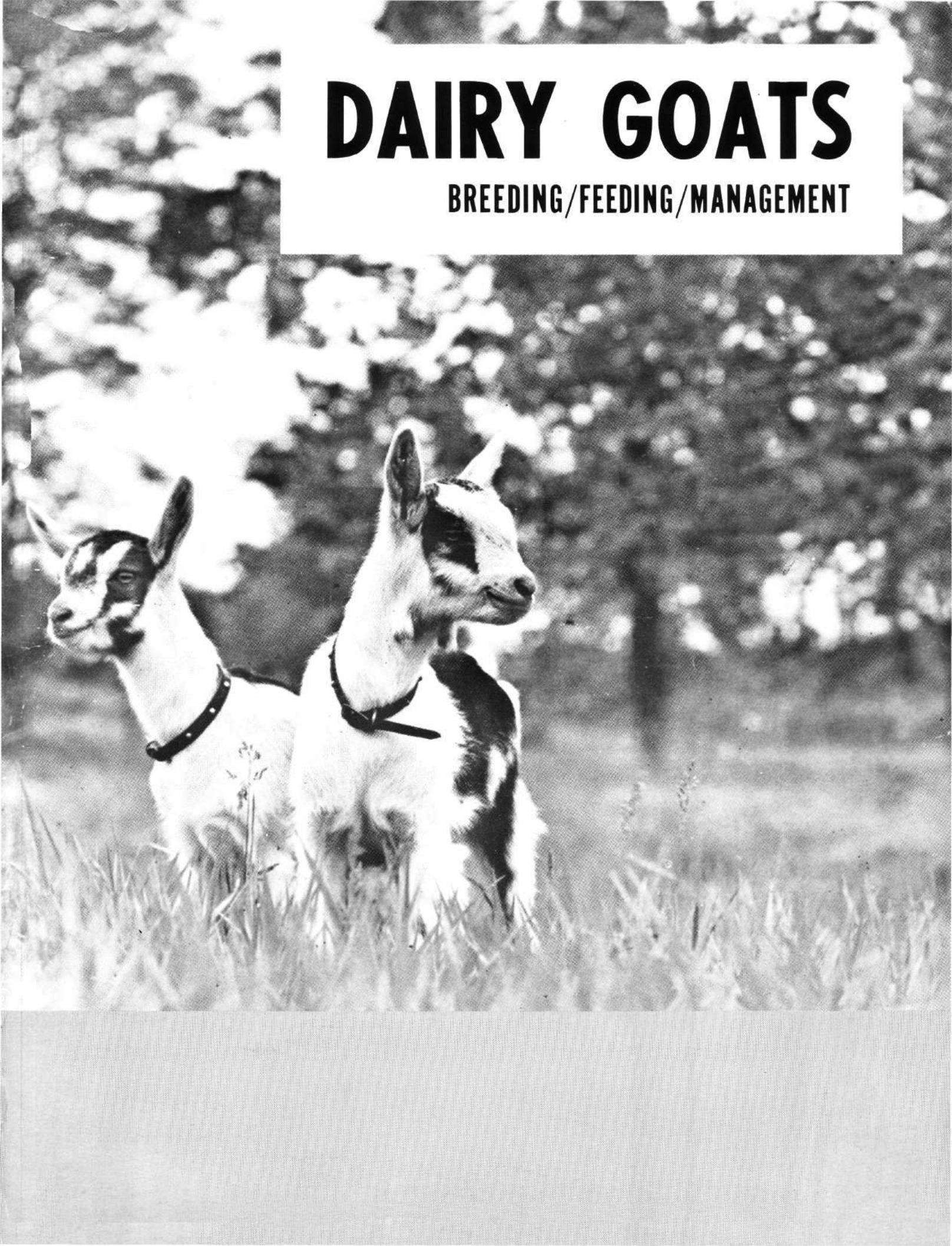
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DAIRY GOATS

BREEDING/FEEDING/MANAGEMENT



The authors...

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DO NOT CONTAMINATE FORAGE, STREAMS, OR PONDS.

This leaflet No. 439 was originally written for the New England Dairy Goat Industry. In other areas of the U.S. or in foreign countries consult local Extension Services, Agricultural Colleges, Schools etc. for local climatic and management factors.

Copies of this Leaflet may be obtained for educational purposes in this country in some cases from County and State Extension Services. Order bulk supplies direct from the American Dairy Goat Association, Box 186, Spindale, N.C. 28160 for a modest fee with special bulk rates for County and State Extension Services in the U.S.A.

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COVER PICTURE -- Courtesy of Ralston Purina Co.

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INTRODUCTION

Purpose of Leaflet

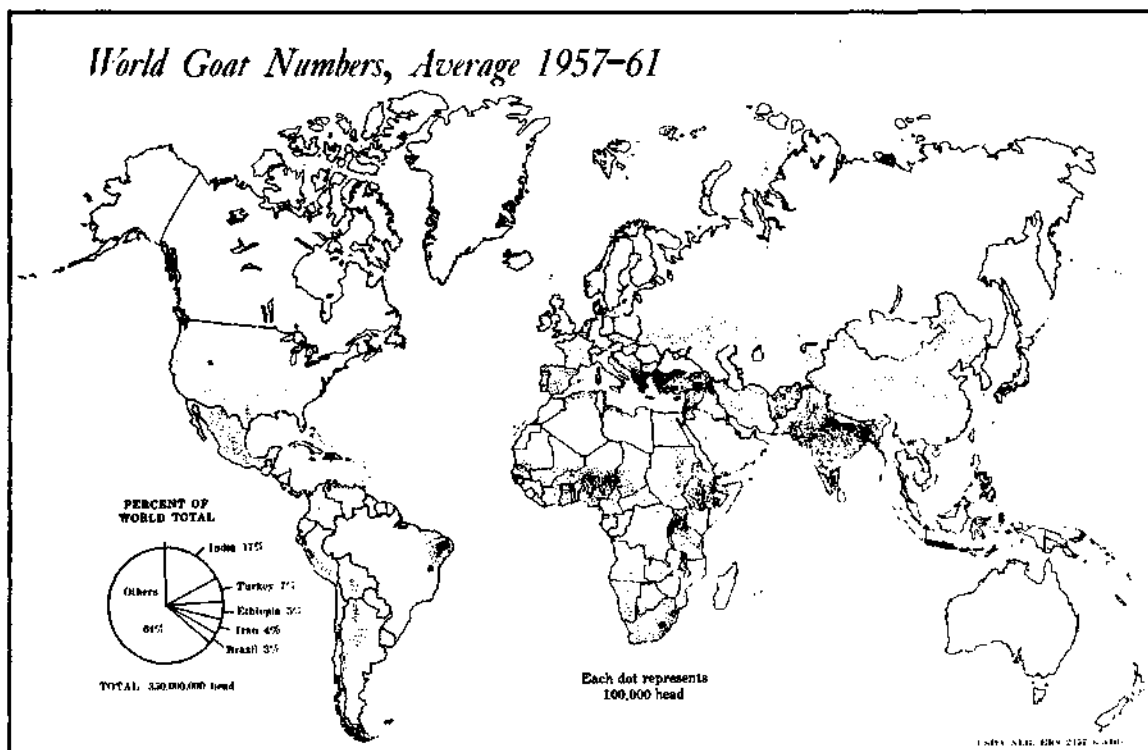
This leaflet is written to be of assistance to both adults and youth who are interested in raising and improving dairy goats in the New England area. It is not complete in its subject matter coverage, but it is intended to treat the more pertinent information of breeding, feeding, and management, so a layman can make a good start in goat production.

It is suggested that all those interested in goat production work closely with their local, state and national associations. These groups can be very helpful in furthering knowledge in the field of goat husbandry.

Origin of the Goat

It is quite certain that the goat was one of the first domesticated animals in Western Asia. He is thought to have descended from the Pasang or Grecian Ibex, a species of wild goat found in Asia Minor, Persia, and other nearby countries. It is also possible that the Markhor may have been represented in the development of the goat, as R. Lydekker states that both the Ibex and the Markhor will breed readily in confinement with domesticated goats. A reference to the use of mohair from goats can be found in the Bible at the time of Moses when he told the Children of Israel to bring white silk and goat's wool to weave altar cloths for the Tabernacle.

Goat Producing Countries of the World



As of 1961, world goat numbers were 350,000,000 head (U.S.D.A. figures). Among the leading goat producing countries of the world are India with 17% of total numbers, Turkey with 7%, Ethiopia 5%, Iran 4%, Brazil 3%. Goats are also found in smaller numbers in Egypt, China, Mexico, Canada, the United States, and many other countries. California is the leading milk goat state in this country; Texas and Arizona are the leading Angora goat producing states in this country. Mohair from these goats is commanding an excellent price in the Boston market.

The first goat importations into this country came from Switzerland. Records of early settlements in Virginia and New England indicate that milk goats were brought to the United States by Captain John Smith and by Lord Delaware. There were very few Swiss goats in the United States prior to 1904. In that year, a consignment of ten Saanens and 16 Toggenburg goats were brought in, followed by more in the next two decades. These goats spread all over the country and have provided the basis for the development and improvement of milk goats in this country.

Dairy goats are not nearly as numerous as dairy cattle in the United States, but, for many other countries of the world, they are the leading milk producers because they are well adapted to limited areas and require less specialized feed, most of which can be produced by the small land owner. There are actually more people consuming dairy goat products in the world than those consuming the products from dairy cattle. This is so because the goat population is large in mountainous areas where they can thrive on grass and browse on brush; whereas, the limited feed in these areas will not support dairy animals. The goat is very helpful to people in small, hilly, dry countries. In this country, the dairy goat eats much the same feeds as dairy cattle because we have the land areas to grow these feeds. As our populations expand and there is more competition for land areas, dairy goat numbers may increase. The animals are ideal for the small rural dweller who works in the city and lives in the country.

Goat Products

The most important goat products are milk, cheese, butter, mohair, and leather. The famous Morocco leather is made from the skin of goats. Water and wine in Biblical times as well as today, in some countries, is carried in goat skins.

Market for Goat Milk

Most New England goat producers consume the milk that their animals produce. Some produce enough to sell to nearby neighbors, but there are very few large commercial producers probably because twice the labor is necessary to produce goat's milk compared to cow's milk. If you intend to go into goat production on a large scale basis, be sure you have a market for milk. Prices received for milk range from 35 to 65 cents per quart.

Goats as a 4-H or Youth Project

Goats make ideal 4-H and youth projects. The animals are interesting, like attention, are not expensive to buy or feed, are easily handled and

transported, and are fun to show at fairs. Young people learn responsibility by having the daily care of goats. They learn about nature's processes by caring for animals and they learn citizenship, sportsmanship, the value of cooperation and of working with others by taking part in the club program.

Goat breeders are usually very willing helpers with 4-H Goat Club, many furnishing leadership and information to help clubs along. A good way to start is to grow into the business by starting with a bred doe or a couple of kid goats.

SOME CONSIDERATIONS IN RAISING DAIRY GOATS

A dairy goat, like all farm animals, is a creature of habit. Be sure you have the time to give your animal regular care before you decide on raising them or you will be disappointed in the results.

New England is rapidly becoming more urban and consideration should be given to your neighbors. Will they object to the noise, odor, flies, etc. of a dairy goat or will they feel that these things are more than offset by the personal appeal and activity of these animals? An objecting neighbor can cause you trouble. Try to get them on your side before buying the animals.

Town regulations - Find out if you live in an area where animals can be raised. Some towns have strict zoning regulations.

Space requirements - Will there be adequate housing or room to erect other buildings, should your project expand? Is there land enough to have an outside yard and pastures and hayland or at least some brushland for browse? The pastures and hayland are not absolutely necessary if you are willing to buy hay and grain. See housing for further details.

WHAT KIND OF GOAT SHOULD YOU BUY?

There are many things to consider when deciding to purchase a goat. Some of these are as follows:

Should I buy a grade or purebred and what is the difference between the two? What are the common breeds of dairy goats and which breed should I purchase? What is good type in a dairy goat and how do I determine this? What effect should production records have on my purchase? Should I purchase young kids or older animals? Let's discuss these points one by one.

Definitions

A purebred goat is one whose parents are both of the same breed and both are registered. The American Dairy Goat Association Registry of Purebreds is open only to those animals tracing their pedigree to original importations. In order to be shown in official ADGA shows, all registered or recorded animals must be tattooed to win a leg on a championship and must be accompanied by papers for proof of breeding.

An American is the result of three successive generations of "grading up" by breeding to purebred sires of one breed. After three such generations of continuous recorded ancestry, the offspring will be seven-eighths purebred and may be registered as American Toggenburg, American Saanen, Etc., if the individual to be registered, as well as the dam and the maternal grandam, are of correct breed type. They are then shown in purebred classes.

A Recorded Grade is a doe with a registered purebred sire or dam and the other parent of unknown or mixed breeding and is recorded in the American Dairy Goat Association grade section, deriving her breed designation from her purebred parent. A doe of unknown pedigree may be recorded as a Native On Appearance (with indication as to breed type) if application for recordation is accompanied by the witnessed statement of a responsible party stating that the doe produced at least 6 pounds of milk in 24 hours, or as Native On Performance if application is accompanied by a statement to the effect that the doe being recorded conforms to a specific breed type. **BUCKS CANNOT BE RECORDED.**

A Crossbred is the result of a mating of purebred parents of two different breeds, and may be recorded in the American Dairy Goat Association Experimental Section.

An Unrecorded Grade is one of unknown or unrecorded ancestry, but she may be a good milker and worth grading up and recording.

Should a prospective breeder buy purebred or grade goats to start an enterprise? A beginner should give serious consideration to purchasing grade goats if cost is a factor. It may be possible in the particular area where the beginner resides, to purchase purebred goats as reasonably as grades because there are more available. Remember there are good and poor purebreds and good and poor grades. Because an animal is registered does not mean it will be of good type and from a high producing family. A grade goat may be of good type and from a high producing family or it may be a nondescript animal of little use to anyone.

If your chief interest in dairy goats is in milk production for home use and for sale, good grade goats would be a good investment if the initial expense is much less. If, on the other hand, you are primarily interested in breeding and raising purebreds for sale and show, you should start with registered animals.

A good purebred doe can seldom be bought under \$100 and may cost considerably more if she is a high producer or is from record-holding stock; even kids from such stock may sell for more than \$100. A good recorded grade milker may be had for less, depending on her production record. Unrecorded grades can be bought for still less, and sometimes prove to be good producers, but without records their purchase is more of a gamble.

Take a person with you who knows dairy goats when you make your first purchase.

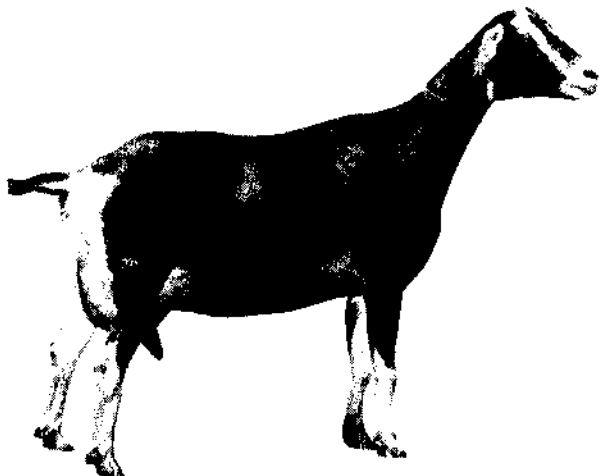
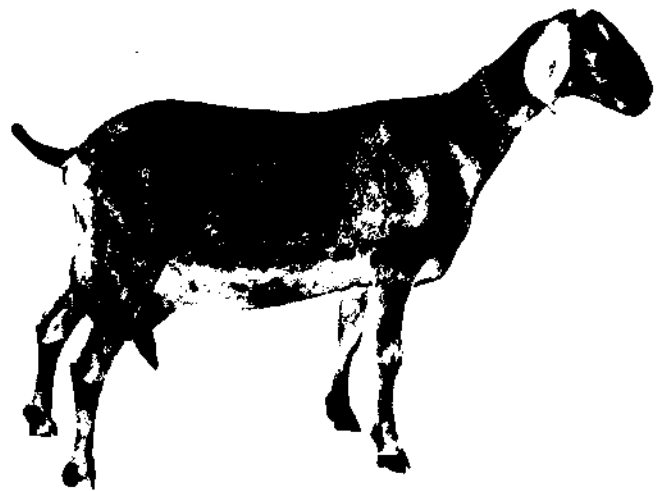
It is important to contact any organized goat association in your area about your proposed purchase. Go to a number of breeders and look at the animals. Get the ideas of many and make few decisions until you have learned something about the animals.

Breeds of Dairy Goats

According to research work done at the USDA Experiment Station at Beltsville, Maryland, over a period of many years, the difference between families and individuals in each goat breed appeared to be greater than differences between breeds. You may look at several breeds and decide you like a certain breed even though that breed may have fewer high milk producers than another breed. You will generally do better with animals that appeal to you personally. On the other hand, if you are going to show, be sure to select a breed that will have enough entries for good competition. Let's discuss some of the breed characteristics of several important breeds.

The five main breeds of dairy goats in this country are French Alpine, American La Mancha, Nubian, Saanen, and Toggenburg. All appear to thrive equally well in every part of the country, and all possess high milking ability. There is little difference in the production records of these breeds, except that the Nubian rarely gives as much milk as the other four breeds, though her milk averages higher in butterfat. The present breed record holders for 305-day milk production are: French Alpine 4826 lbs.; Nubian 4392 lbs.; Saanen 4905 lbs.; and Toggenburg 5750 lbs. Few La Manchas having been on official test, their top record of 3295 lbs. is not very significant. Record holders, it must be remembered, are not average or typical animals.

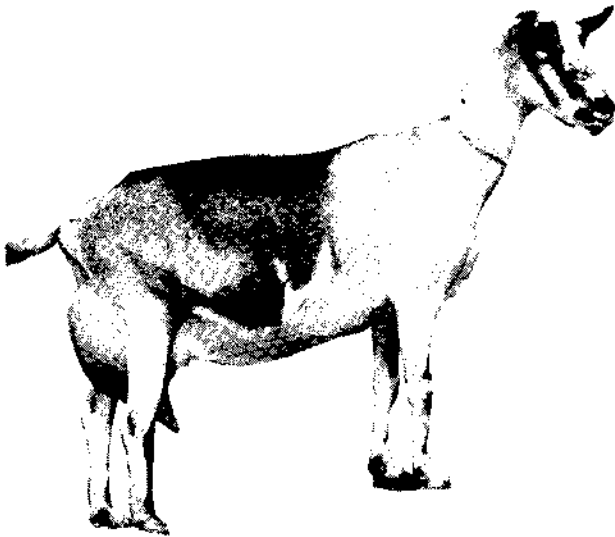
THE NUBIAN - is relatively large and has a proud and graceful appearance. This breed is of mixed origin and owes its distinctive features to the imported goats of Indian Jumna Pari and Egyptian Zariby type. Crossing these with British dairy goats resulted in the Anglo-Nubian which is the foundation of the Nubian breed in the United States. Distinguishing features are long, wide, pendulous ears and the convex roman nose. They may be any color or colors, solid or patterned. Common colors include black, grey, cream, white, shades of tan, brown and rich reddish brown. Common markings include lighter ears, facial stripes, muzzle, crown, and/or undertrim; overall light or dark colored spots or patches of any size are often found.



THE AMERICAN LA MANCHA This breed was developed recently in this country from a short-eared Spanish breed crossed with the leading purebred breeds. They may be any color but are distinguished by their external ears which are either absent or very short. The different type ears are known as "gopher" and "cookie". Their hair is short, fine and glossy. Their faces are straight. Any color or combination of colors is acceptable.

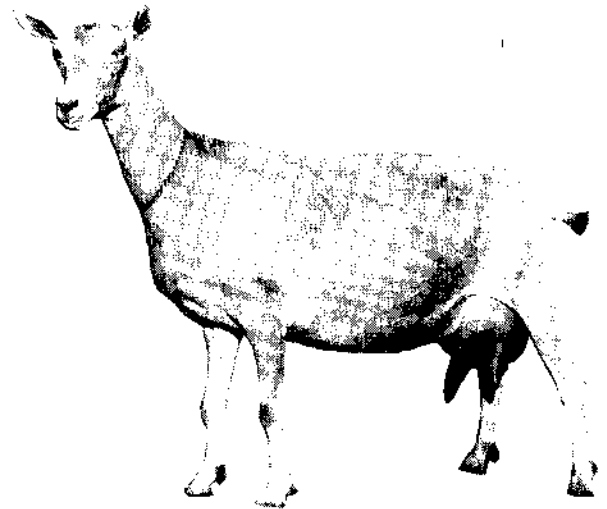
The Toggenburgs and Saanens came originally from the Swiss Alps and the French Alpine from the nearby French Alps, and these three breeds are very closely related and similar in conformation and are often referred to as "Swiss Type". All have erect ears, straight, or as in the case of some Toggenburgs and Saanen, dished faces, an alert and graceful carriage giving them a deerlike appearance.

THE SAANEN - is medium to large in size with rugged bone and plenty of vigor. Does should be feminine, not coarse. In color they may be white or cream and the cream may vary in shade from light to dark fawn. White is, however, preferred to cream. Spots on the skin are not discriminated against, but colored spots in hair are not desirable. The hair should be short and fine although a fringe over the spine and thighs is often present.



THE FRENCH ALPINE - is a large rangy, yet deerlike animal, characterized by an endless variety of color and pattern as follows: Cou Blanc (white neck): Cou Clair (tan neck): Cou Noir (black neck); (The body and hindquarters of the first two of these are usually black or dark in color with the reverse being the case in the (third). Chamoisee (color and marking similar to wild chamois): Sundgau (black with white under-body or with white Toggenburg markings): They are also found in other colors, such as white, pied, cinnamon, strawberry and various shades of red.

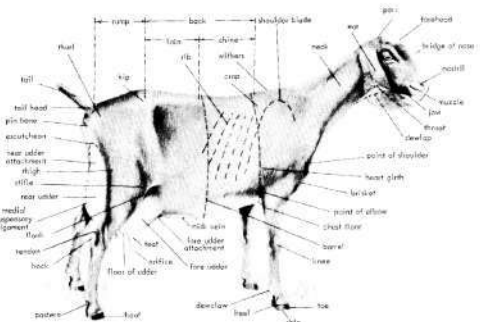
THE TOGGENBURG - is of medium size, sturdy and vigorous. The hair is short or medium in length - soft, fine and lying flat. The color is solid varying from light fawn to dark chocolate with distinct white markings; white ears with dark spot in the middle; two white stripes down the face from eyes to muzzle; hind legs white from hocks to hooves; forelegs white from knees downward; a white triangle on either side of the tail; white spot in area of wattles. Varying degrees of cream markings in place of white are acceptable.



Other less numerous breeds in the United States are Rock Alpines (developed from French Alpines), Swiss Alpines, Norskas and Murcianas: There are also a few British Alpines, British Saanens and British Toggenburgs.

RECOGNIZING GOOD TYPE

Study the outline drawing of the dairy goat. Learn the names of the different parts of the animal and their comparative importance in judging animals. After becoming familiar with type, you will be in a much better position to know what type of animal you are selecting, ie.--good, very good or excellent type animal.



PARTS OF A DAIRY GOAT

(courtesy of the National Miliar Club)

Evaluating Dairy Goat Type

A dairy goat should be angular and not round, hip bones will be prominent, thighs thin, she will have considerable length of neck and her body will be long. Any tendency to be short and thick of body, short of neck, thick in the thighs or in any way fat and meaty is against good dairyness. Meatiness is the opposite from dairyness.

The good dairy goat will be sleek and alert and not fat and sluggish. The animal should be straight as possible on top and especially strong in the chine (see above) and loin area. From the hip bones back to the pin bones (bones on each side of the tail) there will be some slope on nearly every animal. The object should be to get this line as straight as possible.

The shoulder should be refined and not coarse. It should blend into the middle smoothly. The withers or top of the shoulder should be sharp and refined and not rounded as in a meat type animal.

The middle should be long and the rib well sprung, making adequate room for roughage plus two or more kids. The ribs should be long and far apart so you can slide one finger between the ribs. This openness of rib denotes dairy temperament in the goat as well as the dairy cow. There should be some width in the floor of the chest so the front legs will not be too close

together. Width plus the depth of body denotes lung capacity and constitution. It is associated with strength and ruggedness.

The legs of the dairy goat should be straight with adequate width of bone for strength, but not so wide that it appears coarse. The animal should walk easily and freely so it can forage on pasture. The hoofs should be well trimmed so the feet do not become deformed. Long pasterns make the leg look crooked. The pastern should have some angle, but not be so long that the dewclaws touch the ground. Breeding bucks particularly should be heavily discounted if they are weak in the pasterns.

The skin of the dairy goat should be smooth, thin, and pliable. The hair should be reasonably fine to denote quality, but this will vary considerably with the breed.



Good udder



Unbalanced, lacks capacity



Teats too large

The udder should show plenty of capacity and be well held up to the body by the suspension ligament so it will not become injured by banging on stones and other objects in the pasture or around the barn. The low slung udder is called pendulous.

The udder should be pliable and soft and not hard and meaty. Hard bunches in the udder or teats should be discounted in judging or selection. The teats on the udder should be large enough to be easily milked. The milk goat udder should be balanced in shape with teats hanging the same length. The teats should be uniformly placed on the udder if possible and slightly tilted forward. After milking, the udder should be collapsed and pliable like a soft leather glove.

The head of the dairy goat should have an alert intelligent appearance with the ears and head the shape of its particular breed.

EVALUATION OF DEFECTS - SUMMARY

(Revised October 1972)

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GENERAL

BREED SPECIFICS

SLIGHT	1. Broken or wry tail	
SLIGHT TO SERIOUS DEPENDING ON DEGREE	1. Undershot or overshot jaw 2. Close in the hocks 3. Front, rear or side udder attachment lacking 4. Separation between halves of udder or presence of scar tissue 5. Udder of beefy texture or with pocket	
MODERATE	1. Large scurs or stubs 2. Enlarged knees; non-disabling lameness 3. Turned-out or crooked feet 4. Teats that are: a. Set close together b. Bulbous c. Extremely large or small d. Pointed sideways e. Uneven in size f. Having small streams or otherwise hard to milk g. Not clearly separated from the udder	AMERICAN LA MANCHA Mature does less than - Minimum height (28 in.) Minimum weight (130 lbs.) FRENCH ALPINE Mature does less than - Minimum height (30 in.) Minimum weight (135 lbs.) Does with Toggenburg color and markings Does - all white color NUBIAN Mature does less than - Minimum height (30 in.) Minimum weight (135 lbs.) Straight face SAANEN Mature does less than - Minimum height (30 in.) Minimum weight (135 lbs.) TOGGENBURG Mature does less than - Minimum height (26 in.) Minimum weight (120 lbs.) Few small white spots in hair of <u>does</u>
MODERATE TO SERIOUS DEPENDING ON DEGREE	1. Loose, winged or heavy shoulders 2. Narrow chest or pinched heart girth 3. Short, shallow or narrow body 4. Low-backed or steep-rumped 5. Small-boned for body size 6. Bowed-over front knees, buck-kneed 7. Hind legs close together 8. Sprung pasterns (All of these more serious in <u>bucks</u>)	AMERICAN LA MANCHA Roman nose FRENCH ALPINE Roman nose SAANEN Roman nose TOGGENBURG Roman nose

	GENERAL	BREED SPECIFICS
SERIOUS	<ol style="list-style-type: none"> 1. Natural horns (neatly disbudded or dehorned - no discrimination) 2. Udder: <ol style="list-style-type: none"> a. Pendulous b. Too distended to determine texture c. Hard or swollen (except in does just fresh) d. So uneven that one-half is less than one-half the size of the other 3. Leaking orifice 	<p>FRENCH ALPINE</p> <p><u>Bucks</u> with Toggenburg color and markings</p> <p>Bucks - all white color</p> <p>SAANEN</p> <ol style="list-style-type: none"> 1. Dark cream color 2. Several small dark spots in hair <p>TOGGENBURG</p> <ol style="list-style-type: none"> 1. Black color in <u>does</u> 2. White stomach (except British Toggenburgs) on <u>does</u> 3. Large white spot (1½" or more in any direction) on <u>does</u> 4. Few small white spots in hair of <u>bucks</u>
VERY SERIOUS	<ol style="list-style-type: none"> 1. Udder lacking in size and capacity in relation to size of doe 2. Double orifice in teat of does 3. Extra teat or teat (s) that have been cut off on <u>does</u> 4. Crooked face on <u>does</u> 5. Very crooked or malformed feet 	<p>NUBIAN</p> <ol style="list-style-type: none"> 1. Dished face 2. Barely drooping ears
DISQUALIFICATIONS	<ol style="list-style-type: none"> 1. Total blindness 2. Serious emaciation 3. Permanent lameness or difficulty in walking 4. Blind or non-functioning half of udder 5. Blind teat 6. Double teat (s) 7. Extra teat(s) that interfere with milking 8. Active mastitis or any other cause of abnormal milk 9. Evidence of hermaphroditism or other inability to reproduce 10. Permanent physical defect, such as navel hernia 11. Crooked face on <u>bucks</u> 12. Extra teats or teat(s) that have been cut off on <u>bucks</u> 13. Double orifice in teats of <u>bucks</u> 14. Buck with one testicle or with abnormal testicles 	<p>AMERICAN LA MANCHA</p> <ol style="list-style-type: none"> 1. Anything other than gopher ears on <u>bucks</u> 2. Ears other than true LaMancha type on <u>does</u> <p>FRENCH ALPINE</p> <p>Pendulous ears</p> <p>NUBIAN</p> <ol style="list-style-type: none"> 1. Upright ears <p>SAANEN</p> <p>Large (1½" diameter or more) dark spot in hair</p> <ol style="list-style-type: none"> 2. Pendulous ears <p>TOGGENBURG</p> <ol style="list-style-type: none"> 1. Tricolor or piebald 2. Black <u>bucks</u> 3. White stomach (except British Toggenburgs) on <u>bucks</u> 4. Large white spot (1½" in any direction) on <u>bucks</u> 5. Pendulous ears

PRODUCTION RECORDS

Official production records, approved by the American Milk Goat Breeders Association or the State Dairy Herd Improvement Association in the state in which you reside, showing high production records as close as the first or second generation to the animal you are considering for purchase, are of great value. Furthermore, such records indicate a real interest by the breeder in improving his animals. If the breeder can show you the records on the family of the buck and the mother of the kids you are interested in, they should be looked over carefully and given real consideration by you and the experienced goat breeder with you. Beware of a lot of emphasis on milk records back in the fourth, fifth and sixth generation pedigrees. This information is too far back to be of real value.

Many of the better dairy goats in their prime average three to four quarts daily over a period of ten months, giving more at their peak and gradually dropping in production towards the end of their lactation.

Length of lactation or milking period is a very important characteristic in a milking doe.

A goat that produced from 3500 pounds to 4500 pounds of milk yearly is an excellent producer. Beware of records recorded in quarts and pints--volume records are not always accurate. Look for consistence in milk records from day to day.

SHOULD YOU PURCHASE YOUNG KIDS OR OLDER ANIMALS?

Usually kids will be cheaper unless they are from unusually well bred does with high production records. It may be well for the beginner to start with kids and to get acquainted with them and their habits during their growth. This will allow time to become well educated also on what kind of a buck to mate the doe to. Learn what to do at kidding time and learn the management phases of caring for goats.

It is better to have two animals than one so they will be company for each other. A single animal, unless there are others around, will be noisy and lonesome. On the other hand, if you can purchase a well bred doe already mated to a good buck, plus a yearling offspring of this doe at a reasonable price, it should be seriously considered.

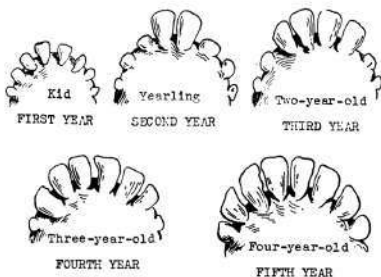
Naturally there is no fixed rule as to what to buy. If you can buy a good old bred doe that will give you some well bred kids at a reasonable price, by all means take her. What you can learn of good type and particularly production for the price you can pay are all important considerations.

The beginner should usually start with a doe rather than a buck. Let the breeder own the good buck at least until you have several does to breed. If you can buy doe kids in the early spring and learn as they develop, then by breeding time a year or so later, you will be ready for the responsibilities of the bred doe.

DETERMINING THE AGE OF GOATS

It should be recognized that there is considerable variation in individual animals and the teeth are only a rough guide as to actual age.

Goats have eight front teeth on the lower front jaw. These teeth are small and sharp in animals less than one year of age. At about one year, the center pair of teeth will drop out and are replaced by two large permanent teeth. At about the 24th month, two more large front teeth appear, one on each side of the first two yearling teeth. The three to four year old has six permanent teeth, two more than the two year old and these come in, one on each side of the two year old teeth. The four to five year olds have a complete set of eight permanent teeth in front. After this age, the approximate age can be told by the amount of wear in the front teeth. As the animal gets older, the teeth spread apart and finally become loose and some drop out. At this age the animal begins to lose its usefulness as a grazing animal. It may be kept on and fed specially prepared feeds, if the animal is still capable of reproduction.



HOUSING AND EQUIPMENT

Dairy goats do not need fancy housing. Old buildings can readily be adapted to cut costs. Those intending to remodel a building for housing goats or build a new one should first visit several other well-constructed goat dairies, gather important facts, then contact the County Agricultural Agent or the State University Agricultural Engineering Department where more basic information on wiring, light, insulation, and ventilation may be gathered.

In any housing plan, arrange for the most efficient method for handling heavy materials such as hay, grain, and manure. Wherever possible, the hay should be stored on the same level as the animals. This will save labor and also the extra cost of building overhead storage strong enough to support baled hay. Baled hay requires much stronger floor joists and supports than does loose hay.

Manure may be dumped daily into a spreader or cart for removal to the fields or a storage pit may be constructed. Placing superphosphate on the manure daily will keep the odor down and make it a better balanced fertilizer. Plan to keep the hand labor out of manure handling wherever possible.

Grain should be stored near the feeding area in rat-proof containers. An outside door with ready access to the grain truck is desirable.

Two types of Goat Housing

There are two main methods of housing dairy goats. 1. Shed type or loose housing, and 2. tie stalls or individual confinement. Some use a combination system, stalls for the milkers and loose housing for the yearlings and kids. There are sound arguments for and against each system. Let us discuss them briefly so that you may choose the method that is best suited for your conditions.

Loose Housing

This type of housing has many advantages. 1. It is more natural for the animal and the exercise resulting from the freedom is desirable. 2. The daily handling of manure is largely eliminated because bedding, when needed, is added to the sleeping quarters, and then the barn is cleaned only once or twice yearly. 3. The bedding, thus added, accumulates, heats, and makes a warm place for the animals to bed down. 4. The building is inexpensive because insulation, solid floors, and ventilation systems are not needed. Eaves troughs, however, are essential so as to keep the roof water out of the yard, and the yard should be paved to keep the animals' feet out of the mud in inclement weather. The yard should slope away from the building so it will drain.

Fifteen square feet of bedded area should be provided for each goat to be housed. A simple shed with three sides enclosed is all that is necessary; the fourth side, facing the south or southwest so the sun will be in the building a good part of the day, should be open, but may be equipped with overhead doors to be used in extremely cold weather. At least ten feet of ceiling height should be planned so that in the spring the pen can be cleaned with a tractor. A clear span type of housing to eliminate support posts is desirable so that turns with a tractor are less difficult. The doors should be wide enough to accommodate the tractor. The feeding area should be on one side of the bedded area as the animals spend a lot of time there and it may require daily cleaning.

There are, however, several disadvantages to consider in loose housing.

1. As all animals are given their freedom, they must either be naturally

polled or be dehorned as the boss goat will take over and cause injury to others. 1. There will be riding trouble when a doe is in heat, so it may be best to remove the animal when there are signs of estrus. 3. More bedding will be required than with the stalls. 4. A milking parlor or separate place to milk the animals is necessary, although the author feels one is desirable for either loose or stall housing as there will be a higher quality product when animals are milked away from the flies, odors, and dusts of the barn.

Confinement Housing

This type of housing also has several advantages. 1. A paved yard is not necessary. 2. Less bedding is used. 3. Because of the individual pens, more attention is given to the individual needs of each animal. 4. It is easier to show the animals to prospective buyers.

The disadvantages of the stall type of housing should also be considered. The building will be more expensive to construct due to the necessity of concrete floors, individual pens, insulation, and forced mechanical ventilation. The individual box stall pen should be six feet square and should contain room for hay and a water pail. Tie stalls may have a raised slat platform which helps keep the goat clean and up off the cold cement floor. The floor underneath can slope toward a cement gutter. Odor can be partially prevented by use of superphosphate underneath the slatted platform, in the trench, and by using lime on the walks in back of the goats. Manure may be flushed into an underground tank, stored in an outside pit, or spread on the fields daily. Walls and ceilings should be insulated. They should be made of materials that can be washed or hosed down for sanitation purposes. Window area should be about two square feet for each animal housed, regardless of the type of housing. This will give adequate light and allow a free flow of air during the summertime.

Tightly insulated buildings should be ventilated with fans that will move twenty cubic feet of air per minute per goat. In cold weather, one mature goat should be housed per 100 cubic feet of air space in the building. The animals furnish enough body heat to activate the thermostat controlling the electric ventilation system. Decreasing goat numbers in cold weather may upset the ventilation plan because the low temperature will not start the fan. Damp, poorly ventilated buildings furnish ideal conditions for poor goat health. Higher air movement is needed in warm weather.

Goat and Kid Barn Plan

The Agricultural Engineering Department of the University of Massachusetts is not recommending masonry buildings because they are hard to properly insulate. A wooden stud frame allows easier insulation.

Milk Room

Consult the local Board of Health before building the milkroom. The milkroom must have a central drain in the cement floor. It is a good idea to have double doors and a hallway between the milkroom and the barn to help keep out dust, odors, and flies. Windows should be screened in the

summer. Double glazed windows in the winter will help keep the room warm. The best planned milkroom will find a separate room for washing and milking the goat and another room for milk cooling, storing, and handling the milk, and for washing utensils. Additional heat in the milkroom may be supplied by a space heater or by several heat lamps.

Suggested Milkroom Equipment

- Electric water bath type milk cooler
- Double sink for washing and rinsing utensils
- A source of hot and cold water
- Milking stand
- Cupboard in which to place sanitized utensils
- Small topped pail, strainer, brushes, and possibly an electric milker if the herd is large enough to demand one
- Scale and record for recording milk weights
- Records for recording breeding dates, etc.

Fences

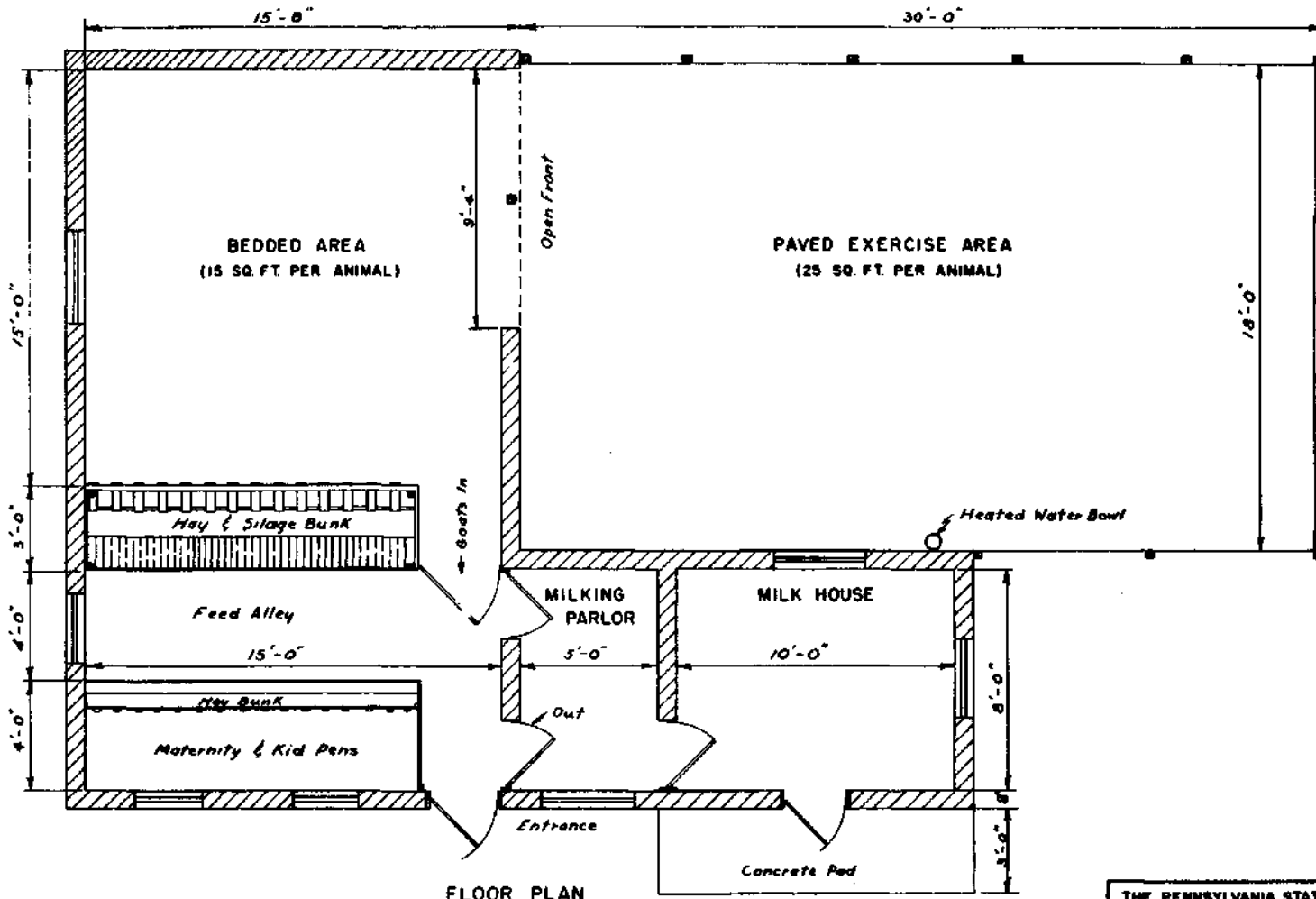
A permanent goat-proof fence should be placed around your boundaries, if you think anything of your animals. A permanent fence can include locust or cedar posts possibly treated with preservatives to make them last. Good posts like these should be used for corner posts and gate posts. You can cut your own posts and treat them with preservatives or buy commercial pressure treated posts. Write the Forestry Department at your State University for details on preservatives.

Steel and iron posts are quicker to put in than wooden posts if the soil is not rocky because they can be driven in. Wooden posts require the added labor of digging post holes. All good fence posts are expensive.

A six-inch stay steel woven wire fence (4½ to 5 feet high) should be adequate. If dogs are a problem, you may need barbed wire on the top and possibly at the bottom. The closer the stays and the heavier the gauge of wire, the more costly is fencing.

An electric fence is satisfactory for a temporary fence or to divide up pasture plots. Three wires approximately 10 inches from the ground, 20 inches for the middle wire and 40 inches high for the top wire are usually adequate and are less expensive than permanent fences. Be sure the electric controller is of a reputable make. Follow instructions of the manufacturer as to construction and insulators, etc.

Some goats will get out of nearly any fence. In this case, place an overhanging wire about 10 inches or a foot from the inside and top of the fence. The wire is supported by offset pieces nailed to the posts. This wire can be electric if necessary, although barbed wire should be adequate. Some people place an electric wire on the inside of the woven wire fence about one foot out so goats cannot get near the fence. The wire may be held by a wooden brace nailed to the fence post. The wire must be held by insulators.



FLOOR PLAN

TO BE USED WITH:
 DAIRY GOAT CORRESPONDENCE COURSE 105
 LESSON 5

24/7/89

THE PENNSYLVANIA STATE UNIVERSITY AGRICULTURAL EXTENSION SERVICE	
LOOSE HOUSING FOR 20 GOATS & KIDS	
ORDER NO. 728-102	SHEET 1 OF 1

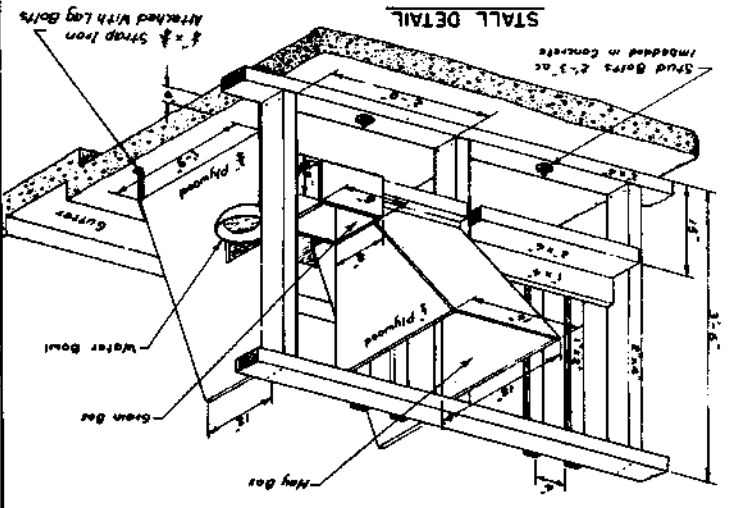
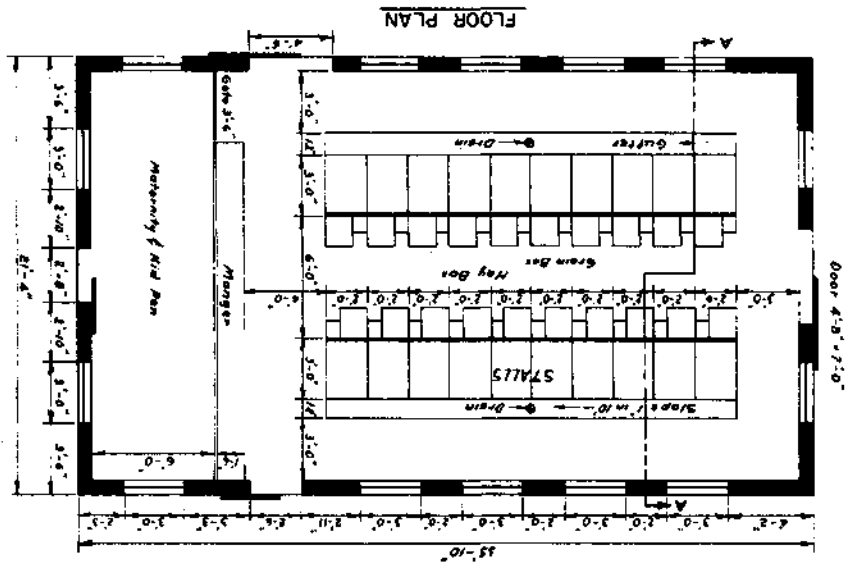
THE PENNSYLVANIA STATE UNIVERSITY
 AGRICULTURAL EXTENSION SERVICE

GOAT AND KID BARN

ORDER NO. 728-103
 SHEET 1 OF 1

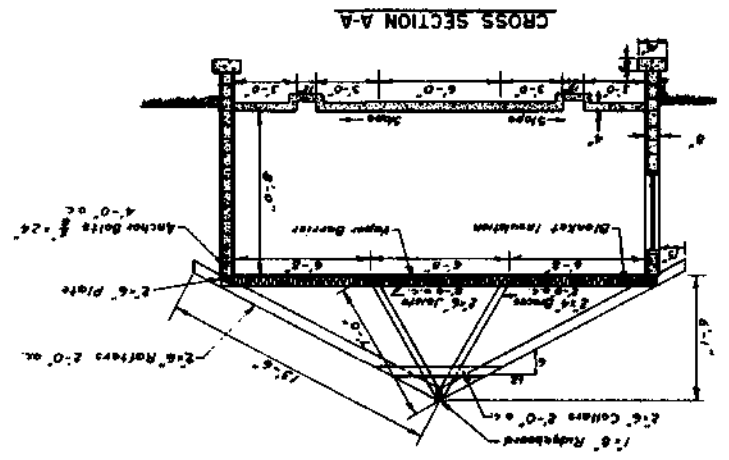
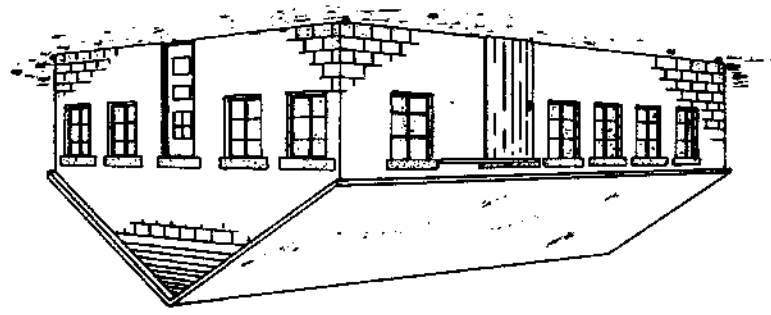
TO BE USED WITH:
 DAIRY GOAT CORRESPONDENCE COURSE
 LESSON NO. 3

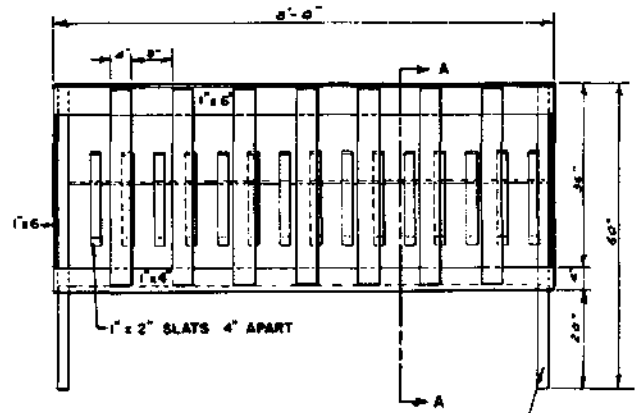
7/7/50



NOTE: For large goats stall width may be increased to 2'-6".

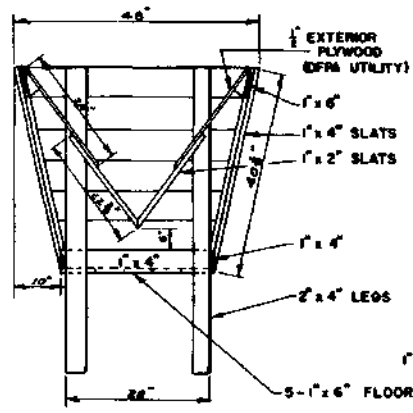
PERSPECTIVE



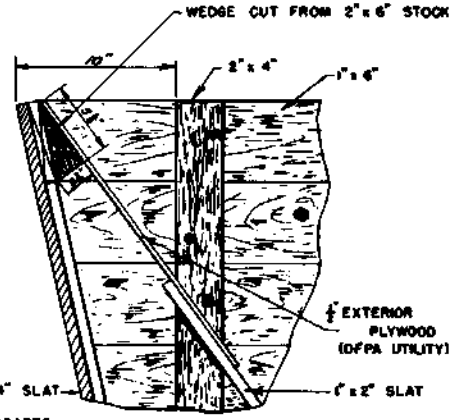


**SIDE VIEW
DOUBLE FEEDER**

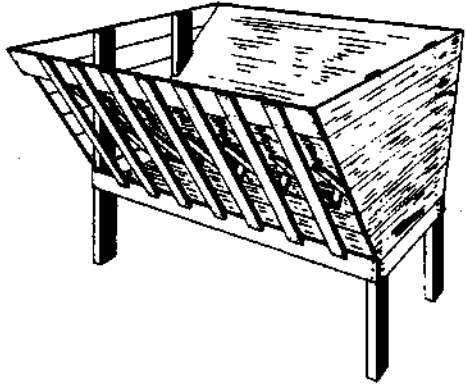
DIP LEGS IN WOOD PRESERVATIVE TO PREVENT DECAY.



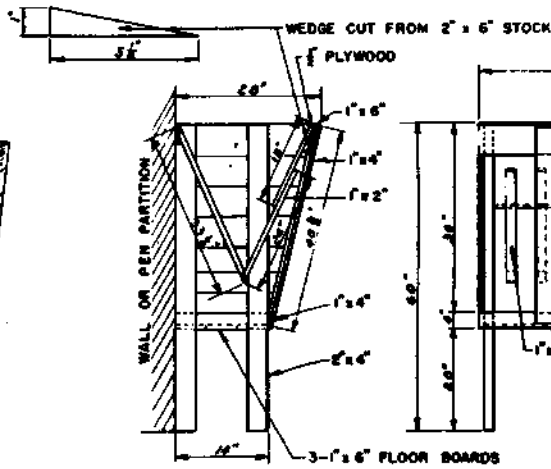
SECTION A-A



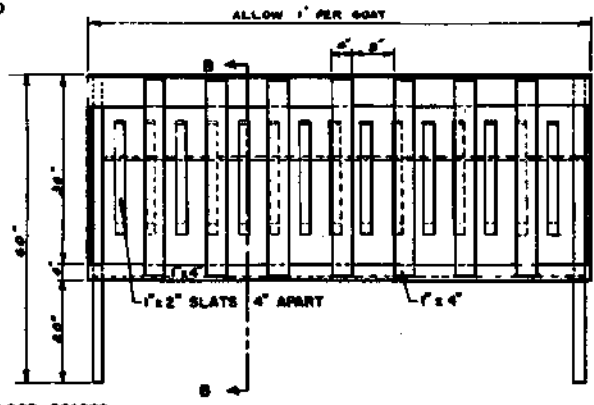
**ENLARGED VIEW OF
CORNER DETAIL**



**PERSPECTIVE VIEW
OF
DOUBLE FEEDER**



SECTION B-B

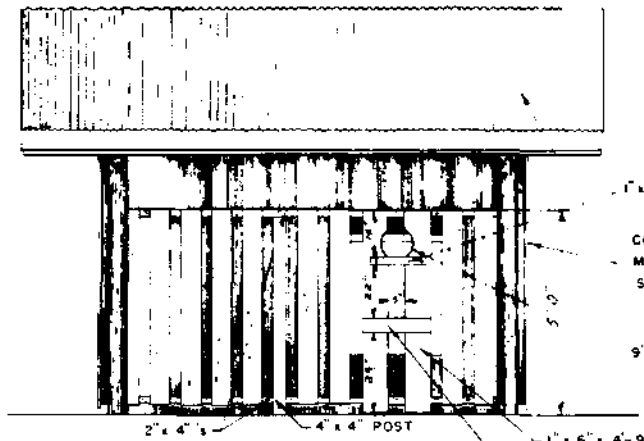


**SIDE VIEW
SINGLE FEEDER**

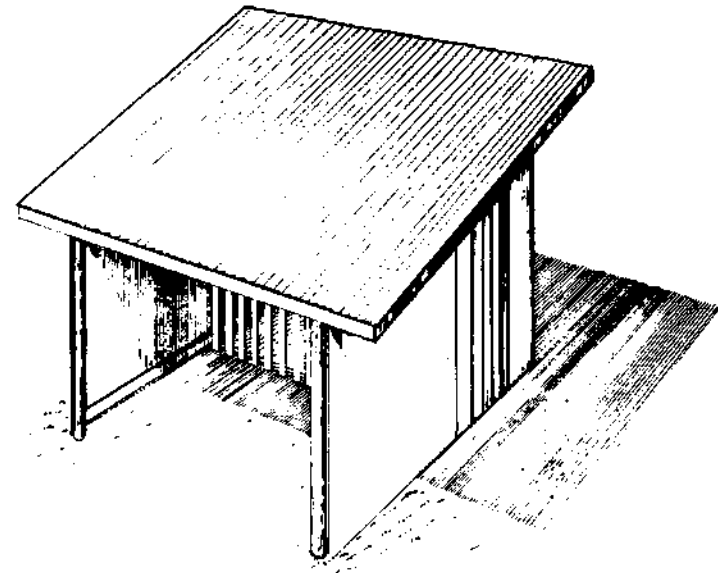
TO BE USED WITH:
DAIRY GOAT CORRESPONDENCE COURSE 105
LESSON NO. 5

THE PENNSYLVANIA STATE UNIVERSITY AGRICULTURAL EXTENSION SERVICE	
FEED RACKS FOR GOATS	
ORDER NO. 728-99	SHEET 1 OF 1

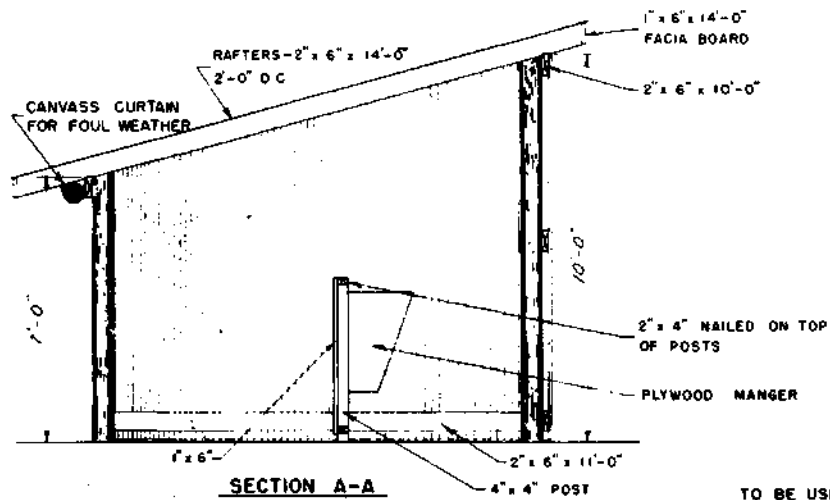
27/7/59



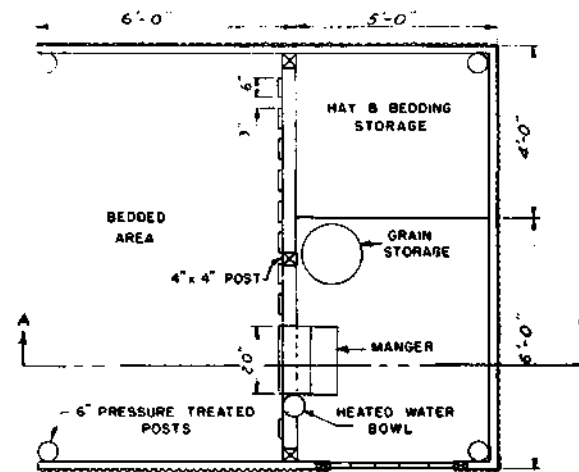
SOUTH END ELEVATION



PERSPECTIVE



SECTION A-A

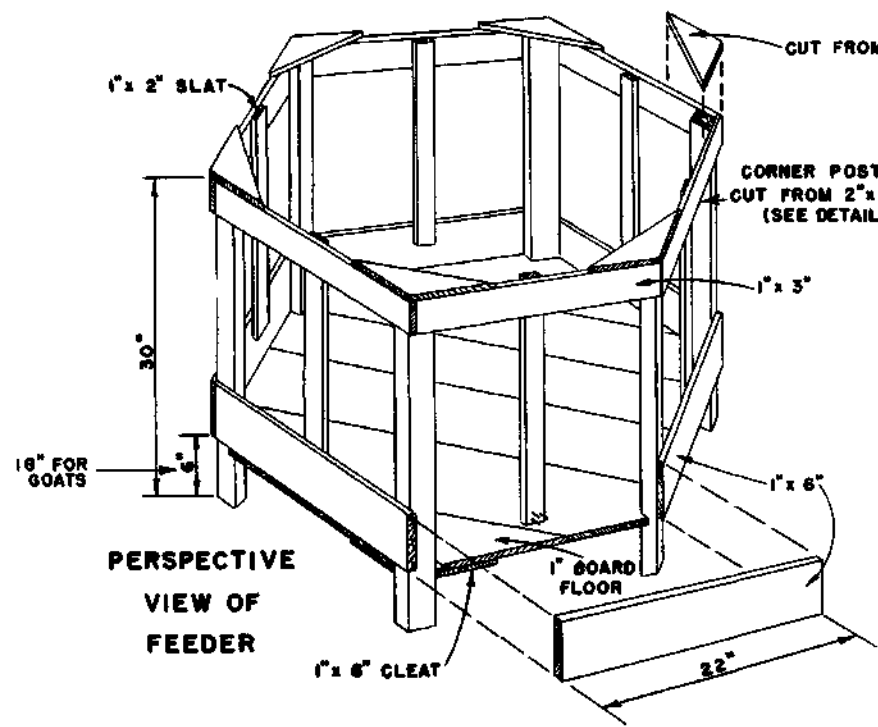


FLOOR PLAN

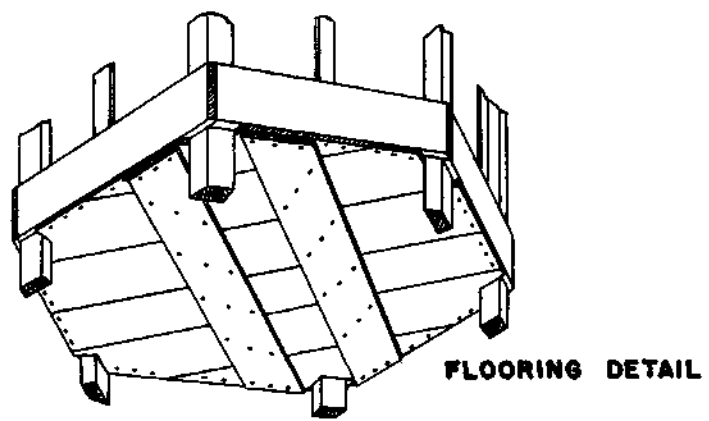
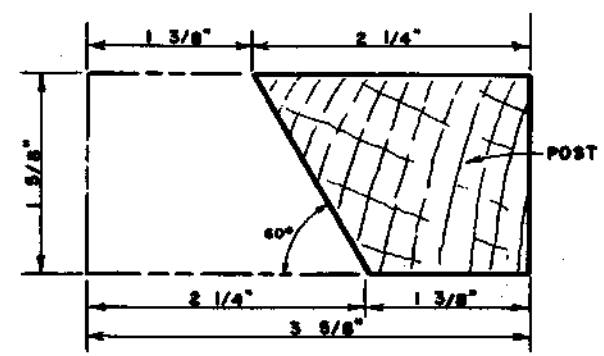
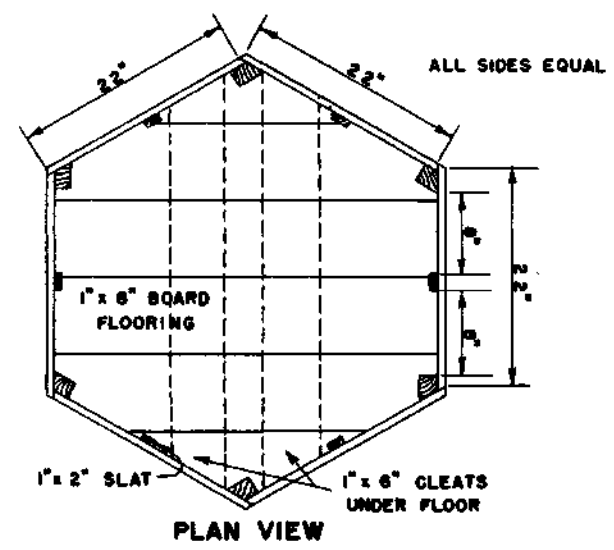
TO BE USED WITH:
DAIRY GOAT CORRESPONDENCE COURSE 105
LESSON NO 4

THE PENNSYLVANIA STATE UNIVERSITY AGRICULTURAL EXTENSION SERVICE	
BUCK BARN	
ORDER NO 728-104	SHEET 1 OF 1

2/11/59



NOTE: (DOES) FOR SMALL EWES AND LAMBS, (KIDS) USE 1" x 6" VERTICAL SLATS INSTEAD OF 1" x 2" AS SHOWN.



TO BE USED WITH:
 DAIRY GOAT CORRESPONDENCE COURSE
 LESSON NO. 9

THE PENNSYLVANIA STATE UNIVERSITY AGRICULTURAL EXTENSION SERVICE	
HAY & GRAIN FEEDER FOR 12 SHEEP OR GOATS ADAPTED FROM U.S.D.A. PLAN EX. 5807	
ORDER NO. 770-80	SHEET 1 OF 1

BREEDING

The regular production of kids may mean the difference between success or failure in the goat enterprise. The male and female are equally necessary for reproduction but we will discuss the female reproductive tract because it has a more complicated job to do than the male tract and thus, more things can go wrong to reduce fertility. A better understanding of the reproductive processes will be possible if the reader studies the drawings as the process is described. If one becomes better acquainted with the complicated reproductive system, one is better able to understand breeding failures.

Anatomy

The two ovaries are really glands which secrete ova or eggs and also chemical substances called hormones which control functions. Attached loosely to the ovaries are small tubes or oviducts. The end nearest the ovary is widened into a sort of a funnel which covers the surface of the ovary; the other end empties into the muscular uterus or womb where the young remains until birth.

The uterus can be divided into two parts; a pair of horns fused together externally for much of their length; and the short uterine body. Closing the uterus and protecting its contents from the outside world is the cervix, a constricted area with heavy walls. Passage through the cervix is difficult because of a series of rings or folds which protrude toward the rear.

Beyond the cervix lies a thin-walled passage, the vagina, which opens to the outside. Just inside the external opening called the vulva is the opening from the urinary bladder which lies below the uterus. Also, you will find a small projection, the clitoris, just inside the lips of the vulva which is a counterpart of the male penis. The vulva and part of the vagina are imbedded in the body wall. The remainder of the organs are suspended within the body cavity by the broad ligament.

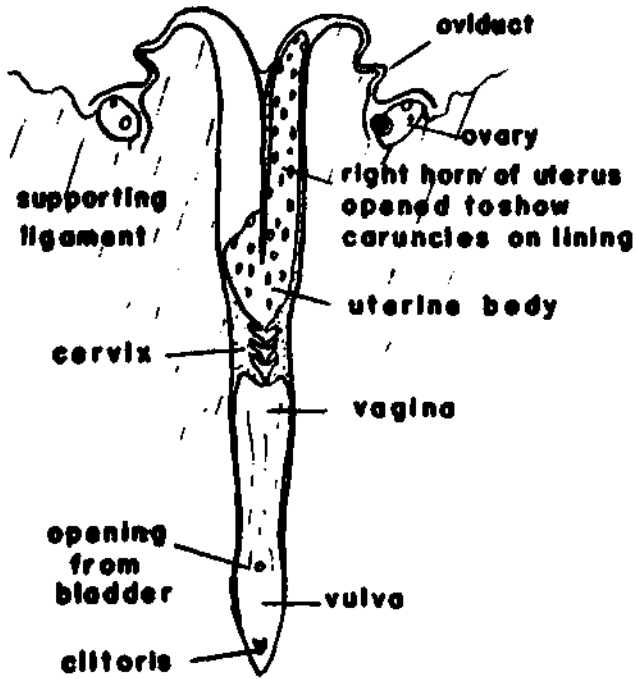
Function

Both does and cows exhibit a series of estrous cycles, during the course of a year, characterized by periods of estrus or heat during which the female will permit mating. These cycles generally last 18-24 days, or an average of 21 days, in the doe. They occur continuously in the cow (until bred), but does seldom come in heat during the spring or early summer. This period without heats is called anestrus.

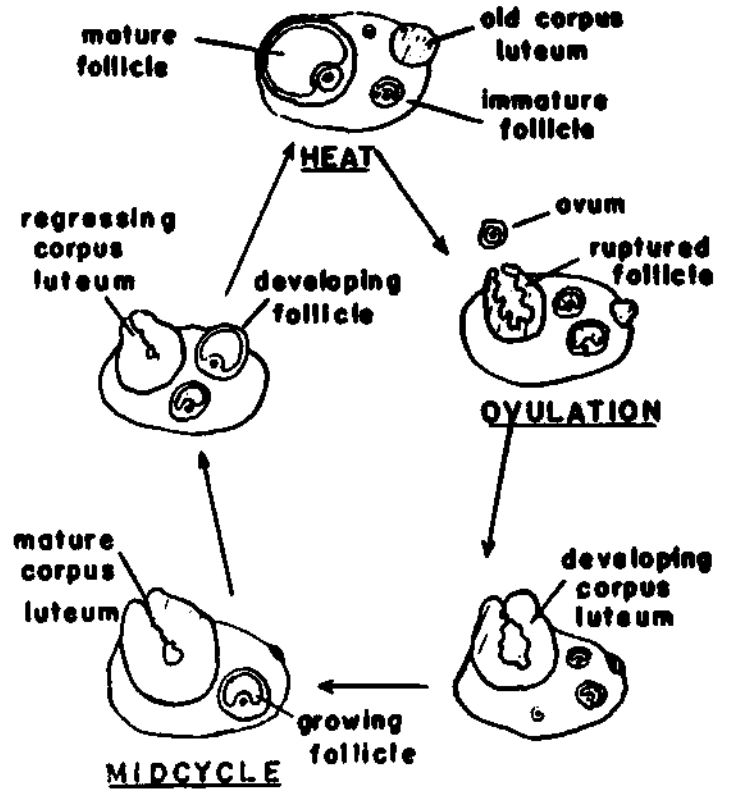
These cycles are associated with changes occurring in the ovaries. At the time of heat, one or more large fluid filled sacs or follicles, each containing an ovum or egg, are found in the ovaries. Toward the end of the heat in the doe, the follicle breaks and the egg escapes, being picked up by the oviduct and passes down to the uterus. The wall of the collapsed follicular sac thickens and in the middle of the cycle, forms a solid glandular structure called the corpus luteum, or yellow body.

REPRODUCTION in the FEMALE

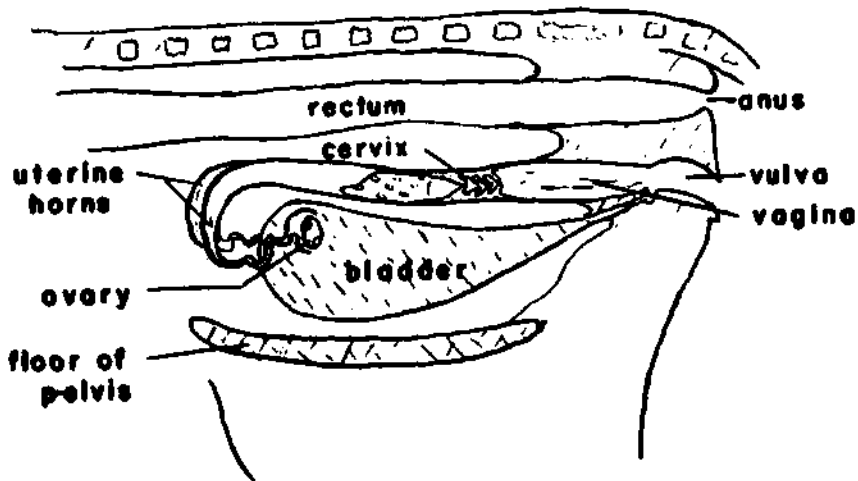
Reproductive Organs in the Ruminant



Cyclic Changes in the Ovary



Relation of Reproductive Organs to other Pelvic Structures



If the doe does not become pregnant, the corpus luteum becomes smaller and loses its function of producing a useful hormone. One or more new follicles grow to large size and the animal again shows heat. If the doe accepts the fertile buck, the liquid semen containing millions of sperm cells is deposited in the vagina near the cervix. The sperm cells are transported through the cervix and uterus, largely by muscular contractions of the female and the ability of sperm to move or be motile. A few of the millions of sperms present manage to travel up the oviducts or fallopian tubes and await the releasing of the egg. The egg is then fertilized by one sperm cell and a new individual is formed. The fertilized egg divides into many cells and passes down the oviduct to the uterus where it continues to grow by cell division. From the developing group of cells, or embryo, are formed membranes (placenta or afterbirth) which attaches the embryo to the caruncles or buttons lining the uterus. The placenta serves to nourish the growing young, transferring nutrients and wastes between mother and offspring.

After a gestation period of about 150 days, birth occurs and the after-birth is expelled from the uterus by muscular contractions. After a period of rest and repair, the reproductive tract returns to normal and the estrous cycle commences again. This is the normal process, but many things can occur between birth and death which reduce fertility of the female or cause sterility or inability to produce offspring.

The Sex Hormone System

Much is still not known about the chemical substances called hormones which regulate reproductive and other important body processes such as metabolism.

The female sexual cycle is begun by the pituitary gland, the so-called master gland located below the brain. This gland is affected by light and temperature. For instance, the short, cool days of the fall stimulate the pituitary to give off a follicle stimulating hormone (F.S.H.). This hormone causes the follicle around the egg in the ovary to give off the hormone estrogen which induces the heat period. The tract is lubricated and prepared for mating by this hormone. The cervix is opened at this time, probably because of the effects of estrogen.

When the follicle in the ovary reaches full size, the pituitary gland produces L.H. or lutenizing hormone which causes the follicle to burst and the egg is released into the oviduct tube. The walls of the follicle then produce lutein, a temporary gland often called the yellow body, which secretes progesterone, a hormone which has the opposite effect of estrogen. It maintains pregnancy, causes heat to subside, closes the cervix, and seals the womb. The womb then relaxes and the blood vessels prepare to supply the unborn kid with food. Progesterone is continuously supplied by the yellow body and maintains pregnancy until the fetus is mature. Then, this hormone ceases to function, and estrogen is again active, relaxing the cervix, lubricating the vagina, contracting the womb, and helping birth processes.

Reproductive Failures

There are many known and unknown reasons for reproductive failures in the doe. Some of these are as follows:

Unfertile sperm from buck

Abnormal egg

Diseases such as brucellosis and vibriosis in the female

Hormone malfunction such as retained yellow body

Overfat condition of doe can prevent conception

Very hot weather may prevent conception or cause the fertilized egg to be aborted

In isolated cases, malnutrition or lack of protein, energy, the mineral phosphorus and the lack of vitamin A, can prevent normal reproduction

A normal foetus may be aborted due to the female being injured by other animals or being bumped in a narrow door opening.

The study of the various causes of reproductive failures is an important field for students interested in zoology and physiology.

Age to Breed Does

The normal breeding season for the dairy goat is from late August to mid-March. Most of the does are bred in September, October, and November and produce offspring in February, March and April. Because goats are seasonal breeders, the milk supply may be short for 2-3 months during the late fall and winter months. Planned mating can largely overcome this.

Does should not be bred until they weigh 85-90 pounds or are about 10 months of age. Earlier breeding will stunt the growth as the animal may not receive enough feed for its own maintenance and growth, the growth of the foetus and later the production of milk.

Breeding Records

Breeding records should be kept on every doe. This will not only allow planning the milk supply, but also will be a detection device to pick up any abnormal heat periods which may lead to infertility if not caught in time. Furthermore, the records can help you plan ahead on the kidding date and for the special feeding and management needed at this time. It will be found that different does have breeding peculiarities which wouldn't be noticed without notes which can be helpful in developing a breeding history. These notes may be helpful in culling certain does from your herd and in planning orderly replacements.

Signs of Estrus or Heat

Estrus is the period when the doe will receive the buck. Usually this period lasts 2-3 days and is characterized by uneasiness, riding other animals, or standing for riding, shaking of the tail, frequent urination, and bleating. The vulva may be swollen, red, and some mucous may be evident. It is best to breed the doe in the second day of the heat period because

conception is usually more successful at this time. A milking doe will give less milk during estrus. If she is running loose with other goats she will be a problem to the whole herd and should be placed in a box stall until she is quiet again.

Gestation Period

The gestation period is the period from conception to kidding. Normally this period is from 145 to 155 days or an average of 150 days.

GESTATION TABLE FOR GOATS

(Based on average gestation period of 150 days)

When Bred In:	Will Freshen: (Breeding day less number below)*	
	Month	Day
July	December	— 3
August	January	— 3
September	February	— 3
October	March	— 1
November	April	— 1
December	May	— 1
January	June	— 1
February	July	0
March	August	— 3
April	September	— 3
May	October	— 3
June	November	— 3

*To determine day due to freshen take breeding day and subtract the number indicated in the table. For example, if bred July 10th doe would be due to freshen December 7th; if bred November 20th she would be due April 19th.

Number of Offspring and Sex Ratio

It is common for a doe to have two offspring. In records kept in New Mexico of 115 does, over 18 months of age, 26 produced one kid, 55 produced two, 30 produced three and four produced four kids which is at the rate of 2.1 kids per pregnancy. Does under 18 months of age average about 1.5 kids each.

The sex ratio in goats tends to be about 115 or more males produced to 100 females.

Birthweight of kids is normally just under six pounds (5.7) with the males weighing a bit more than the females.

Selection

Selection is the complicated art of saving the best of the offspring to go back in the herd or be sold. Selection of the best females plus careful choice of a buck are the very heart of successful dairy goat breeding. First, any unsound animals are removed from the group. Some of the unsoundnesses are as follows:

1. Overshot or undershot jaws

2. Mixed sex or a condition called hermaphroditism. This is not uncommon in dairy goats and is indicated in doe kids by an enlarged vulva, the tip of which may contain a small pea-shaped body. Some of these animals may be capable of reproduction but should never be saved.

3. Cryptochid condition in the male is an unsoundness in which one or both testicles of the male fail to descend into the scrotum. Some of these animals are capable of reproduction, but as the condition is inherited, they should never be used as breeders.

4. Extra teats on the side of other teats can cause a problem at milking time, especially if the teat canal on the extra teat goes to the outside. Extra teats may be removed when the goat is young with a pair of surgical scissors without the loss of blood. When two teats are close together, the animal should be discarded.

5. Young animals with twisted legs or feet, very poor type, lack of size for age, and those lacking the right characteristics of the breed should not be saved.

After the above rigid culling, carefully analyze the production pedigree of the first and second generation relatives of each remaining kid, and save the best for your herd replacements. Bear in mind that there is little value in records beyond the third generation. The first generation only has a 25% influence, the second 6.25%, the third only 1.56%, the fourth .39%, and the fifth only .1%. The best animals should not be sold for breeders unless you have more good ones than you can raise. Selling poor animals hurts the industry and the breeder who makes the sale.

Remember, too, that selecting for too many things in a herd such as production, type, breeding history, size, length of body, etc., makes for slow improvement. Select for a few practical things which makes a financial contribution to the herd such as milk production and type.

Always use a purebred sire. If you can use a positive proven sire, you are in luck, because accurate records prove what he can do. If a sire increases the quantity of milk in his offspring over that produced by the dams (daughter-dam comparison) he is considered an outstanding buck.

Systems of Breeding

There are several systems of breeding.

Inbreeding - Inbreeding is the mating of closely related animals such as brother and sister or parent and offspring. Inbreeding should be done only by those that understand that the bad is reinforced as fast as the good. Those that use inbreeding should be willing to cull the offspring heavily for any undesirable characteristics. Inbreeding has been done in developing most breeds of livestock and can be very useful when properly handled. However, it is not advisable for the novice, because he may not understand the consequences.

Linebreeding is a mild form of inbreeding and is different from inbreeding only as to the degree of inbreeding. Inbred animals are usually the use of a succession of related sires, but not being more closely related than 25%. This system is used considerably by the good breeder in order to retain a high degree of relationship to a certain individual.

Outcrossing is the mating of unrelated animals. Improvement comes slower by this method because the two animals mated have widely different inheritance.

Crossbreeding is the opposite of inbreeding as it works with unlike genes. It is the mating of two different breeds or lines within a breed. It will often increase the size of the offspring particularly if two inbred lines are crossed. Crossbreeding also tends to give a certain amount of hybrid vigor to the offspring.

Grading up is the practice of continually mating purebred sires to grade animals and their offspring. If this practice is continued and selection is practiced for several generations, great improvements over original stock can be brought about. In fact, the final product may be considered purebred and may be registered.

Artificial Breeding

Artificial breeding of dairy goats is now possible in America. If you plan ahead, you may be able to study a list of sires and their pedigrees sent to you by the breeding association, so you can be more selective in the use of sires. If you call on short notice, you may have to use semen that is available right then and it may not be from the buck you want to use.

Artificial breeding has many advantages to the goat breeder. Some of these advantages are as follows:

The artificial breeding association is experienced in selecting sires on the basis of records.

The breeding association may have access to more sires and probably proven sires from some states such as California. It may allow you more choice in a sire than you can get locally.

There would be a saving of expense in feeding a sire.

The problem of buck odor, special fences and housing, etc. would be eliminated.

You could use the extra space released by the buck for keeping productive animals. It is now possible to freeze goat semen and breed does after the sire is dead.

If you are interested, call or write one of the following:

American Dairy Goat Association
P. O. Box 186
Spindale, North Carolina 28160

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How is Artificial Breeding Done?

First, the doe in heat is detected. Second, contact the artificial breeding center ahead of time. Third, a breeding technician will come and breed the identified doe. The doe in heat or estrus should be plainly marked and in a stanchion or at least secured. A plastic catheter or thin tube is attached by the technician to a small syringe containing the male semen and seminal fluid. The catheter is inserted in the female vagina and the male seminal fluid is forced into or sprayed over the cervix of the female. The sperm works through the cervix and into the fallopian tubes where the sperm fertilizes the egg or eggs.

If you possibly can, be present or have someone else present to restrain the doe during breeding. If inseminators do not get the needed cooperation on this, they may give up this worthwhile service as they work on a very busy schedule and a lot of time can be wasted with a doe that jumps around and refuses to cooperate.

Sanitation

The inseminator is trained and follows strict sanitation procedures for the protection of the goat owners. He must clean and disinfect his boots before entering and after leaving the premises and he must clean and disinfect all equipment.

Inseminators need 100% cooperation of the goat breeder to be most effective. Artificial insemination should be of real assistance to the goat breeder, particularly to the small breeder who cannot keep a proven sire.

FEEDING THE DAIRY GOAT

The nutritional requirements of the dairy goat have not been accurately determined by scientific research as they have for other classes of livestock. Therefore, it is difficult to balance rations because standards for different ages, weights, pregnancy, and lactation are lacking. The dairy goat's feed requirements are probably much like that of a dairy cow per unit of body weight. The dairy goat in general produces more milk than the cow from the same comparative quantity of nutrients per unit of body weight. Size considered, however, the goat uses more feed for the processes of digestion and metabolism than the cow.

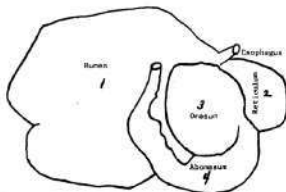
The best bred dairy goat in the world would be a miserable failure unless properly fed and managed. A well-known breeding authority, Prof. V. A. Rice, has stated that "75% of the breeding goes down the throat" - meaning that the good breeding in an animal can be brought out only by proper feeding.

In the following paragraphs, the very interesting nutritional processes of ruminants will be discussed with the idea of broadening the nutritional interests of the reader and furnishing a foundation on which to build the practical feeding of the mature doe, the buck, the growing yearling and the weanling kid.

The Ruminant

A ruminant is a cud chewing animal such as a goat, cow, or sheep having a specialized four-compartmented stomach specially adapted to digest roughages such as grasses, hays, and silages. A ruminant can use up to 50-80% roughages and hays in the diet. The simple stomached animals such as the pig, horse and human must eat a smaller amount of bulky feeds and a larger amount of concentrated feeds or grains. Ruminants are well adapted to the New England area because we grow largely roughages here and very little grain.

Sketches of the four-chambered stomachs of the young calf and the mature cow. The dairy goat relationships between young kids and mature animals would be in approximately the same relationship.



Relative Capacity	
Calf	Cow

Legend	
1 - Rumen)	
2 - Reticulum)	85%
3 - Omasum)	
4 - Abomasum)	15%

The drawings illustrate the changes in the ruminant's stomach as it develops from that of a calf or kid eating largely milk to that of a cow or a mature doe. Notice the change in the size of the various compartments as the animal develops. The four-chambered stomach is composed of: 1. the rumen or paunch, 2. the reticulum or honeycomb, 3. the omasum or manyplies, and 4. the abomasum or true stomach. Digestion in the young goat is much the same as in a single stomached animal, as the first three compartments mentioned above are small and inactive. As the young goat starts eating roughage and grain, the rumen or fermentation vat becomes functional and enlarges rapidly until it represents nearly 80% of the total stomach size.

The Rumen

The bacteria and protozoa which are found in the rumen operate without the presence of oxygen. The bacteria supply enzymes to break down fiber and other parts of feeds, build protein from simple nitrogen compounds and manufacture many of the vitamins needed by the animal. In contrast, the simple stomached animals must have most of the vitamins supplied to them. However, these bacteria must be properly fed to do their job.

How the Digestive System of the Ruminant Works

Roughage consumed by the goat, is chewed, soaked with saliva, swallowed, and goes to the rumen where it is attacked by the bacteria and digestive juices. The bicarbonates of the saliva are important in neutralizing the volatile fatty acids produced by the bacteria in the rumen. The movements of the muscular walls further mix the materials so it can be more readily attacked by the bacteria. At regular intervals materials in the rumen and reticulum are returned or regurgitated to the mouth for further chewing. The reticulum (second compartment of stomach) also acts as a pump of fluids and is active in the regurgitation process. The omasum or third stomach is thought to have mainly a mechanical function. As materials become more liquid, they are forced into the abomasum for further digestion and then on to the small intestine where pancreatic bile and intestinal juices aided by movements of the intestine further digest the material. The walls of the abomasum secrete the enzyme pepsin and hydrochloric acid as well. These together begin digestive action on the proteins before they are sent to the small intestine.

The pancreatic juice contains the enzymes trypsin, chymotrypsin and carboxypeptidase which change proteins into proteoses and peptones and then into amino acids. The enzyme amylase, and amylase that changes starch into malt sugar and the enzyme steapsin, lipase that splits neutral fats into fatty acids and glycerol. The bile salts from the gall bladder on the liver are an important aid in digesting fats.

The small intestinal wall gives off several enzymes of great digestive power. Several peptidases act on proteoses and peptones breaking them into amino acids, the building blocks of proteins. Another group of enzymes secreted into the intestine changes complex sugars into simple forms like glucose which can be readily absorbed.

The walls of the intestine contain many small projections called villi. These move because they have muscular walls and are able to expand and contract. They are specially adapted to absorb the digested foods. The capillaries or small blood vessels in the mucuous membrane of the intestinal wall carry the food materials to the blood stream and then to the heart where it is transported to all parts of the body in the circulatory system. Nutrients in the blood go to the capillaries and then into the lymph surrounding the cells and are subsequently absorbed into the cells.

Nutrient Metabolism in Goats

The feeding requirements of the goat, with its four compartmented stomach, is different than with simple stomached animals (such as man, poultry and hog). The following points emphasize the basic fundamentals of goat nutrition:

1. The metabolism occurring in the body tissues of the goat requires the same nutrients as the body tissues of other animals. Metabolism refers to: a. the building processes for growth, production and maintenance and b. the breakdown processes of feed and stored nutrients for energy and other body requirements and breakdown of worn-out body cells.

2. However, due to the tremendous population of microorganisms in the rumen, the goat can consume and digest materials high in fiber, utilize effectively poor quality protein and limited amounts of urea and synthesize most of the vitamins it needs.

3. The requirements we need to be concerned with in the practical feeding of goats are for dietary amounts of energy, protein, water, vitamin A, calcium, phosphorus, salt (NaCl), iron, copper, zinc and cobalt. Common rations contain enough of the other essential minerals and enough fat to meet the daily needs.

First discussed will be metabolism in the paunch and, therefore, unique to ruminants, and second, the functions of the various nutrients in the body tissues and organs.

Reactions in the Rumen

Protein quality--a term referring to the amino acid composition of proteins--is of no consequence in ruminant nutrition. All the essential amino acids, the building blocks of proteins, can be synthesized by the rumen microorganisms if a sufficient amount of protein is present. In fact, these microorganisms can even convert a certain amount of non-protein nitrogen (NPN) such as urea to form essential amino acids. The proteins formed are of high quality and are equivalent in value to meat and milk proteins.

The microorganisms present in the rumen also perform many other "services" for their host. High fiber materials, hay, silage, and other forages are digested to a much greater extent than in single stomached animals. The microorganisms secrete enzymes that attack the hard-to-digest cellulose (fiber) and convert it to volatile fatty acids (VFA). These are very diges-

tible, and are used for energy by the host. Even the highly digestible carbohydrates like the starches and sugars are converted to VFA. Between 50 and 75 per cent of the goat's energy requirement is absorbed from the rumen in the form of the three VFA's--acetic, propionic and butyric acids.

Another function performed by the rumen microorganisms is to synthesize most of all the vitamins. Vitamin K, and the B-vitamins, pyridoxine, pantothenic acid, biotin, folic acid, vitamin B₁₂ (if cobalt is present), and certain other vitamin-like materials are all synthesized by rumen microorganisms. The goat, like other animals, can synthesize vitamin D from a pro-vitamin D compound (ergosterol) on the skin in the presence of sunlight.

Vitamins and Minerals Directly Related to Energy and Protein Metabolism

The composition of the body gives us some insight into its requirements. The bones are composed of calcium (Ca) and phosphorus (P). Therefore, Ca and P must be in the diet. The organs, tissues, enzymes and hormones are composed of protein. Protein must be in the diet. Even after maturity the Ca and P levels must be maintained in the bone, and protein in the tissues must be replaced as it is worn out. Growing animals need plenty of Ca, P and protein for body structure and tissue development.

But what drives this animal? ENERGY--the fire of life! Exercise, food digestion, enzyme synthesis, milk synthesis, tissue growth, bone growth, fat deposition, hormone synthesis and even maintenance of the body requires energy. The body processes converting feed energy to energy needed for production, growth and maintenance require many of the minerals and vitamins as cofactors or helpers to the enzymes carrying out these reactions.

The mineral, phosphorus, plays a very vital role in energy metabolism. Certain phosphate compounds form so-called "high energy bonds" which trap the energy in feed as it is broken down in the body. This trapped energy is then used to drive the body reactions necessary for growth, maintenance and production.

The formation of the high energy phosphate bonds through the stepwise breakdown of carbohydrates and fats involves many of the vitamins. The B-vitamins, thiamine and pantothenic acid, are components of co-enzymes involved in metabolic pathways as glucose is converted to acetic acid. Pantothenic acid is especially important in utilization of the volatile fatty acids produced in the rumen as well as the higher fats of the body.

The B-vitamins, niacin and riboflavin, also play central roles in oxidation of carbohydrates and fats. These vitamins carry hydrogen (H) atoms from the carbohydrate and fat molecules through a "hydrogen transport system" to react with oxygen to form water. Also needed in this system are the trace minerals iron and copper. Deficiencies of any one of these nutrients may result in symptoms closely resembling starvation.

Protein metabolism requires energy, vitamins and minerals. The B-vitamins folic acid, pyridoxine and vitamin B₁₂ are necessary for normal protein synthesis. The trace mineral cobalt is very necessary for all ruminants and is a component of vitamin B₁₂.

Other Functions of Vitamins

Vitamin A is required for normal vision and also maintenance of skin and other epithelial tissues such as the digestive tract and reproductive organs. The ruminant needs vitamin A in the diet or the vitamin A precursor carotene to maintain breeding efficiency, to produce strong, healthy offspring and to have normal resistance to infection. Reproduction rate is markedly reduced when vitamin A and/or carotene are low.

Vitamin D--the sunshine vitamin--is necessary for calcium and phosphorus absorption and metabolism. A deficiency in either vitamin D or Ca or P may result in production of rickets in growing animals or osteomalacia (brittle and weak bones) in the adult.

Vitamin E seems to be required for normal reproduction in the rat. Its absence may result in degeneration of the testes, re-absorption of a developing fetus in the female and general reproductive failure. In ruminants its absence may result in muscular dystrophy, so-called "white muscle disease." The toxic element, selenium, in minute amounts appears necessary for proper vitamin E nutrition and strangely enough is also necessary for normal growth. While not synthesized in the rumen, vitamin E is widespread in livestock feeds and added supplementation is generally not required.

Vitamin K is essential for the normal clotting of blood, is synthesized by rumen microorganisms and presents no problem in ruminant nutrition.

Other Functions of Minerals

Many of the mineral elements as well as the vitamins are necessary as cofactors to enzymes and may even be components of enzymes. Magnesium is an enzyme cofactor whenever high energy phosphate bonds are used or produced and is a cofactor to certain other enzymes as well as being an essential component of bone.

Iron (Fe) is an essential component of heme which in turn is a component of hemoglobin and the red blood cell--important as a carrier of oxygen and carbon dioxide. It is the iron of hemoglobin to which the oxygen and CO₂ attach. Without adequate Fe in the ration the animal becomes anemic. Also, without adequate copper (Cu) an animal may become anemic. Apparently, the Cu is needed in heme synthesis and Fe utilization. Certain nervous disorders are attributed to Cu deficiency.

The role of iodine (I) in the body is as a component of a hormone secretion of the thyroid gland. This hormone controls the rate of metabolism in the animal, actually controlling the amount of energy available for the various body processes.

Sulfur (S) is a component of two sulfur amino acids needed in the body proteins and body compounds that compose the nails, hooves and cartilages. Most all proteins including enzymes and hormones contain sulfur.

Manganese is needed for normal reproduction and bone formation. Its deficiency results in delayed sexual maturity, weak or dead offspring, degeneration of testicular tissue in the male, and physical and chemical changes of the bone.

Zinc (Zn) is an essential component of several enzymes of the body. One, an enzyme digesting proteins when they pass into the small intestine. Another converts carbonic acid of the blood to CO₂ and water. Other functions of Zn are indicated in skin tissue and bone metabolism. Scaly hide may result when Zn is deficient.

Sodium (Na), chlorine (Cl) (supplied as sodium chloride or salt) and potassium (K) are needed primarily in acid-base and osmotic pressure balances of the body. Na and K bicarbonates are the primary components of saliva and are very important in neutralizing the volatile fatty acids produced in the rumen. Chlorine is needed for the hydrochloric acid secreted into the true stomach.

Calcium is needed in the bloodstream as well as in the bone. Marked decreases in blood Ca result in tetany (Milk Fever) and death if not remedied. Certain levels appear necessary to provide the proper environment for the functioning of the heart and other organs.

Experiments with mature animals using radio-active Ca have shown a continued loss of Ca from the bone and subsequent loss from the body. Therefore, even a mature non-producing animal must be continually supplied with Ca and P in the diet.

Phosphorus, as we have mentioned, is a major component of bone and is widely distributed in soft tissue serving as the essential link in transfer of energy from the feed to body tissues for growth, maintenance, and production. Phosphorus is also a component of many enzyme systems. A symptom of P deficiency besides rickets is "pica" or depraved appetite where the animal may chew on wood or bones. The ratio between Ca and P is quite important; the ratio of two parts Ca to one of P apparently results in the best nutrition of both elements if vitamin D is present.

Fat Requirements

Some fat seems to be needed in the diet. The normal amounts of fat (3-5%) in forages and feeds seem to supply the needs for normal body functions. In fact, just a little additional fat in the diet of a ruminant will result in depressed appetite and the animal going "off feed." There is some fat in every body cell encasing the hydrogen transport system previously mentioned. Growth and milk production is depressed in the complete absence of fat.

To date no evidence has shown the synthesis of the so-called "essential fatty acids" by microorganisms of the rumen. The unsaturated fatty acids linoleic, linolenic and arachidonic appear to be effective in correcting a diet deficient in fat while the saturated fats are not effective.

Nutrient Balance

As more is known about body function and metabolism, definite inter-relationships are found to exist between minerals, vitamins, and the role they play in the body. Ca, P, and vitamin D are closely interrelated in normal bone metabolism. Molybdenum, a toxic mineral, in excess interferes with copper (Cu) and sulfur (S) metabolism and this toxicity can be counteracted by increased feeding of Cu and S over and above normal dietary requirements. Excess fluorine (F) is toxic. While small amounts appear necessary for healthy tooth formation, an excess results in weak teeth and poor production primarily because the animals cannot eat well. Selenium in amounts of 10 parts per million (0.02 lbs/ton) is toxic while 0.1 ppm (.0002 lbs/ton) may prevent "white muscle disease." Excess of an essential mineral may result in toxicity symptoms and a productive response as poor as that of a deficiency. An excess of phosphorus may interfere with Ca metabolism and vice versa. Large intakes of iron, aluminum and magnesium interfere with phosphorus absorption by producing insoluble compounds.

Many problems of animal feeding arise from nutrients and other non-nutrient substances being present in excess. Many of the trace minerals are very effective poisons. Certain other metals and organic compounds are also poisonous. Normal, healthy, productive animals require sound feeding and management. All nutrients need to be present in a definite relationship to each other and to the animal's needs. Deficiencies or excesses result in impaired body metabolism and function. Pronounced deficiencies or excesses may result in death or at the best inefficient growth and production.

Pastures and Roughages Cut Feeding Costs

Of all classes of domestic livestock, the goat can do the best on unimproved pastures and even brush. They are a browsing animal. They like weeds and some plants not eaten by other livestock. This is why the goat thrives in the land areas of the world which are hilly, mountainous, and incapable of supporting other classes of livestock other than certain breeds of sheep. In this country, it is the custom to fertilize our fields and pastures in order to raise greater amounts of feed.

Most livestock production is based on making the best use of improved pastures in the summertime and early cut, properly fertilized and cured roughages such as hays and silages for winter feeding. In winter goat feeding, 14 to 18% commercial sheep and goat grains are fed to balance the extra needs of the animals not met by the roughages.

Information on how to improve pastures and haylands by liming and fertilizing is placed here for those that wish to pursue this method of feed production.

Pastures and Pasture Management

Improved pastures are necessary for the proper feeding of does and yearlings unless large acreages are available. It is a mistake to turn goats onto spring pasture until there is a growth of 3-4 inches of grass, as they may graze it too closely, kill off the pasture plants, and encourage the

growth of weeds. It is also possible to so over-stock pastures with animals that all vegetation is consumed and the animals lose weight and become victims of both a lack of feed and internal parasites. Internal parasites are encouraged particularly in wet weather by a lack of sufficient feed for the animals and closely cropped pastures. Therefore, it is quite evident that properly managing both the kind and amount of pasture and the number of goats put on the pasture is all important to success with these animals.



Good pastures other than brush land are the most economical goat feed. The pasture season should be planned so the animals always have adequate grazing. The best pastures for goats would include: alfalfa-brome grass, clovers, clover and grasses, such as timothy, ladino clover mixed with other legumes and grasses, and blue grass during good growth. Sudan grass or the millets properly managed, are also good pasture grasses, particularly in the dry seasons.

Temporary pastures. A good early spring and fall pasture is rye or wheat. Barley also makes a fine early spring or fall pasture. These fields may be sown

in September at the rate of two bushels per acre for fall and spring pasture and fertilized at the rate of 500-700 lbs. of 10-10-10, or its equivalent, per acre. In New England, definite planning for pastures is needed in the July and August period when rainfall is light. A good annual pasture is dwarf Essex rape broadcast at the rate of 6-7 pounds or drilled at the rate of four pounds per acre any time from April to July 1. Rape will furnish grazing 4-6 weeks after seeding. One bushel of oats sown with the rape will usually give more feed and insure against a rape failure. Rape may be pastured, rested, and pastured again.

Aftermath grazing of cut-over hay land makes good supplementary grazing for goats. Care should be taken, however, not to overgraze alfalfa seedings in the fall or the plants will winter kill.

Increase pasture feed by topdressing. Small herd owners may not have equipment for developing good pastures. They may not be justified economically in hiring the necessary work done for small herds. Poultry manure makes an excellent topdressing material and is usually available at lower cost than commercial fertilizers. Other manures adequately supplemented with nitrogen and phosphate would also be good fertilizers. In still other cases, considerable pasture improvement may be accomplished by soil testing with the help of your county agent, then liming and following recommended practices for complete fertilizer top dressing once or twice yearly at the rate of 500-700 pounds per acre of 10-10-10, or its equivalent. With adequate rain, plenty of good grazing will result. In some cases, thin, weedy sods may not make the expenditure profitable and reseeding is advisable. On hilly, stony, or poorly-drained pasture land, poultry manure or commercial fertilizer will provide good extra grazing. If grasses predominate,

topdress with the amount and kind of fertilizer recommended above. If legumes such as alfalfa or clovers predominate, topdress with 500-700 pounds of 5-10-10, or its equivalent.

Pasture or hay land should usually be limed at the rate of two tons per acre every 4-5 years. Usually more is required when reseeding. See your Extension Agent for details.

Management of Goats on Pasture

Goats need salt every day. It should be fed as a loose salt, never in block form, as goats will not eat enough block salt to meet their needs. If goats are grazing on old, unfertilized, unimproved pastures made up largely of grasses, the supply of calcium and phosphorus may be low. In this case, mix dicalcium phosphate in equal parts with the trace mineral salt and feed free choice in weather protected feeders. Otherwise, growth and production will be slow due to the lack of minerals. Calcium and phosphorus are needed for all body processes and are the two most important minerals in goat feeding.

Shade and water are very necessary for goats on pasture. On hot summer days, the animals may suffer unless they have access to shade. Trees are adequate or a simple shade can be built with a few posts and boards or aluminum roofing. Water is needed for all body processes and is particularly necessary to help goats dissipate heat in hot weather.

Rotate pastures. More grazing for goats will be made available if the pasture area is divided into lots and the animals are moved from one area to the other at ten day to two week intervals. For this system to work well, the number of goats grazing will need to be reasonably well adjusted to the available feed supply for the 10 day to two week interval. Obviously, if the areas are too large or there are not enough goats in the particular lot, the grasses will grow up and be coarse, stemmy and unattractive to an animal that prefers the tender shoots. Clipping such pastures will make this feed supply more attractive to the animals but may not be economically feasible in all cases.

The rotation of pastures is also especially important for breaking up the internal parasite cycle. The parasite load from the hatching parasite eggs in goat manure increases the longer they are kept on a given plot of land. At the same time, the grasses are getting shorter and the feed supply less, so the chance of the goats consuming the worm eggs are greater. Placing the animals on a fresh strip of grazing allows the action of the sun to dry out the worm eggs on the old lot and the goats get extra feed by being on fresh growing pasture. Furthermore, the old lot has a chance to rest and grow some fresh tender grasses.

Roughages for Goats

The cheapest feed for goats other than brush lands and pasture is good quality legume hay, such as alfalfa, alsike clover, red clover, ladino clover, soybean hay, vetch and birdsfoot trefoil or mixed hays containing the above legumes. Coarse-stemmed hay will be eaten but many of the stems will be pulled onto the floor and wasted and goats will need more of this kind of hay, because they select the more tender leaves and stems. A good early cut, mixed hay, one-half legume and one-half grasses, is well liked by goats.

Stem crushers used on many farms today as an aid in curing hays, are making coarse roughages more attractive to goats. They will eat more of the coarser stems after crushing. Legume hay is well liked by goats and contains the needed proteins, vitamins, minerals, and energy. Such hays are sometimes somewhat laxative when fed alone.

In some New England States, it is difficult for part-time goat farmers to buy good goat hay from the grain dealers. It would pay them to contact nearby farmers who raise good hay for their cattle and buy it in the field at haying time. In some cases, it will be cheaper and better than that bought at many dealers as their handling costs are high. Furthermore, you will better be able to judge hay quality if you see the hay when it is cut. Look for fine-stemmed, green colored, leafy, early-cut hays. Learn how to recognize good hay so you can buy it intelligently.

Mixed hays containing the legumes and grasses, such as timothy, red top, sudan, and brome grasses, are acceptable if they contain 50% legumes. If grass hay alone is used, more costly grain will need to be fed to balance its lower protein content. Second-cutting hays are preferred so the goats will not waste the stems of coarse first cuttings.

Research work now indicates that early cut grass hays properly fertilized can be nearly as good a feed as legume hay. We may see a shift back to the grasses, as grasses do not have to be reseeded nearly as often as legumes which is a saving as plowing, harrowing and reseeding are expensive.

How to Determine Hay Quality - Cornell Study

In determining hay quality find out when it was cut if possible, look for leafiness and lots of good green color. Hays may be analyzed at your State University for feeding value.

1. Stage of growth when cut (the more mature, the more loss of feeding value)

	<u>Digestible protein</u>	<u>Energy as T.D.N.</u>
a. vegetative stage	18.7%	70%
b. bud stage	14.5%	63%
c. bloom stage	10.2%	56%
d. mature stage	6.4%	49%

2. Leafiness - important (more proteins and vitamins in leaves)

3. Green color - very important

- need 35-60% original color
- lose color - lose 90% vitamin A
- one or two rains on dry hay causes loss of 40-60% feed value

4. Compare alfalfa, a legume hay, and timothy, a grass hay, as to feeding value. Notice that the later grasses are cut, the lower the protein content.

	<u>Digestible protein</u>	<u>Energy as T.D.N.</u>
a. early bloom timothy	4.2%	51.6%
b. full bloom timothy	3.2%	48.0%
c. late bloom timothy	2.4%	47.5%
a. leafy alfalfa	12.1%	51.1%
b. good alfalfa	10.3%	51.1%
c. stemmy alfalfa	8.2%	47.5%

Feeding the Pregnant Dry Doe

Some persistent milkers will milk up to 4-6 weeks prior to kidding. It will be difficult to dry some does off, but they should be rested for six weeks prior to freshening. Pregnant does should be well fed because the unborn kids put on 70% of their weight during the last 6 weeks prior to kidding. The doe should put on some reserve flesh prior to kidding. Good pasture will maintain a doe at this time or the feeding of legume hay. However, if the doe is lacking condition and appears to be thin, feed $\frac{1}{2}$ to $1\frac{1}{2}$ pounds of a mixed grain daily. The protein content of the grain, whether 14 or 16% should be determined by whether the pasture or hay is legume or mixed legume hay. In late summer and fall, protein levels are lower in pastures. It is quite important that an adequate amount of protein, energy, minerals and vitamin A be available at this time. The unborn kids are growing rapidly and need protein and the minerals calcium and phosphorus for muscle and bone development. A combination of a dry pasture season and hay that has been wet several times and lacks color can produce weak or dead kids or kids that die shortly after birth because of low carotene supply. Adequate carotene is usually stored in the liver during the pasture season except in smaller amounts in very dry years. Good green pastures or roughages with green color are normally excellent sources of vitamin A. Even roughages lose part of their carotene content when they are stored several months, so beware of hays that are stored from one year to the next.

Feeding Just Prior to Kidding

A few days prior to kidding, decrease the mixed grain supply by nearly 50%, and replace this with the laxative feed bran which is also a good source of both protein and phosphorus. Bulky hays may also be cut back, provided lost nutrients are replaced with other more easily digested materials. The laxative bran will help to clean out the digestive tract so it is not distended thus competing for space in the region of the vagina through which the kids will pass. Usually this will assist does to kid more easily.

Feeding the Lactating Doe

A milking doe will require about 500 pounds of hay and 450 pounds of grain yearly. Milking does should have all the high quality roughages they can consume. Alfalfa or clover hay is desirable. Early cut, green colored, grass hays are good for milking goats, but should be supplemented with a higher protein grain--16-18%. Pasture grasses can take the place of one-half of the concentrate or grain fed.

The grain should be fed at the rate of $\frac{1}{2}$ pound grain for each one pound of milk produced. Grass hays will usually require 16-18% protein grain and legume a 12-14% grain depending on the quality of the roughage. On good pasture, milking does usually only need one pound of grain for each four pounds of milk produced.

Goats like silages, roots, cabbage, and other high moisture feeds. Usually, these are fed at the rate of about 2-3 pounds per 100 pounds of body weight.

Suggested rations:

clover or alfalfa hay--3 pounds daily plus
grain--12-14% protein--1 to 2 pounds or more depending on quantity
of milk produced

legume or mixed hay--2-3 pounds daily plus
silage or roots--1.5-2 pounds daily plus
mixed grains (16%) protein--1-2 pounds or more depending on quantity
of milk produced

Minerals

Calcium and phosphorus are the two minerals needed in largest supply by dairy goats. When dairy goats are being fed good hay from fertilized land and a commercially mixed dairy ration, there is usually little need of furnishing extra minerals. It is generally impractical to buy commercial minerals mixes as they are expensive. To be on the safe side, some goat breeders mix equal parts of salt and dicalcium phosphate and make it available to the animals, free choice in the stalls, in the loose housing pen or on pasture. This mineral mix supplies calcium, phosphorus and the needed sodium and chlorine from the salt. This is a safe, economical mineral mix.

The trace minerals, iron, copper, zinc, cobalt, etc., are seldom deficient when mixed grains are fed because these grains generally contain the trace minerals as an additive by the grain company. Over-supply of copper can cause sudden deaths. Remember, we sometimes worm goats with a nicotine copper sulfate solution for tapeworms, the drinking water may come through a copper pipe, and when grain high in copper is fed, plus offering animals a trace mineral salt, the copper supply can build up and the animals may die suddenly. Although copper is very necessary, it is poisonous when available in too large amounts.

Force feeding of minerals containing flavored supplements should be avoided. The animal may under these conditions consume toxic quantities with subsequent undesirable effects. When feeding commercially mixed grains, mineral supplements generally are not needed. If given, they should not be fed with the grain but given free choice. It is easy to upset the mineral balance by force feeding minerals unless amounts are carefully calculated by an experienced person.

Feeding the Breeding Buck

The breeding buck is a very important factor in the goat herd so he should be properly fed. High quality hay in large quantity will help maintain and grow the buck at a reasonable cost. When not being used for breeding, good pasture alone will maintain the buck in good health. The buck may be fed good quality hay plus $1\frac{1}{2}$ pounds of grain daily to meet his needs when inactive as a breeder. Free choice of water and dicalcium phosphate and salt mixed $\frac{1}{2} \times \frac{1}{2}$ are always desirable in the barn or on pasture.

The feeding of excessive grain when the buck is inactive may cause the animal to be fat, sluggish and even sterile. Two weeks before and during the breeding season, increase grain rations 1-2 pounds daily or more if the buck is large and is covering numerous does daily. The feeding of poor hay low in phosphorus and vitamin A can cause the animal to be sterile as phosphorus and carotene are necessary for reproduction in the female as well as the male.

If you want to mix your own buck feed, try 100 pounds each of oats and corn, 50 pounds of bran and 25 pounds of soybean or linseed meal. One and a half to two pounds of this during the breeding season should be adequate along with good hay. Regular exercise is almost as important as feed for the buck.

Feeding Yearlings

You should be able to feel the ribs of a growing yearling. If they can't be felt, you are feeding too much grain. The object is to feed young animals enough for maintenance and growth, but not enough to fatten them. Browse, good pastures, high quality hay and a place to exercise are all very desirable for growing stock. The needs will be met if you feed $\frac{1}{2}$ to $1\frac{1}{2}$ pounds of grain daily. The amount and percentage of protein in the feed should depend on the size of the animal and quality of the roughage being fed. Free choice of water and a mineral mix of equal parts of dicalcium phosphate and salt are good management practices.

Feeding the Kids

Giving kids a proper nutritional start without expensive goat milk is a good practice; particularly if you can sell the goat milk for a higher price than necessary to buy cow's milk for the kid. Goat's milk is ideal for growing out a kid, but you lose your income during this time. If you intend to rear the kid without mother's milk, never let him nurse. Milk the colostrum or first milk from the mother and feed it at body temperature to the kid from a nipple bottle. Continue this for three to four days. The colostrum is laxative, high in carotene, protein, and other nutrients, as well as antibodies which are so necessary to the newborn kid's digestive system and developing tissues. The nipple bottle is usually preferred over pan feeding of milk as it is more natural for the kid and less air is gulped which can cause digestive upsets.

Calf Feeds for Kids Excellent commercial calf grains and milk substitutes may be used to rear the kid without feeding any milk except the colostrum. This is a common practice with goat producers. The milk replacer is

supplemented with Fe and Cu (normally low in milk) as well as antibiotics to aid in the control of scours.

Suggestions for Feeding and Managing Kids

1. Always warm the milk or milk substitute to about 103-105° F.
2. Always wash and sanitize the bottle, nipple and pan if one is used, after each feeding. Undesirable bacteria can cause sick kids.
3. Feed the kid 1½-2 pints of milk or milk substitute daily.
4. If you need the goat's milk and it brings a higher price than what you pay for cow's milk, gradually change to cow's milk.
5. Feed milk three to five times a day as the stomach capacity is small.
6. When the kids are 3 weeks to a month old, gradually add a good calf starter to the milk and increase the amount as the kid can take it without digestive upsets.
7. If you want to mix your own kid feed, mix 30 pounds of each of corn meal, ground oats and wheatbran. Add to the above mixture, 10 pounds of soybean meal or linseed meal, whichever is the cheapest.
8. Start offering the kid fine second cutting, green colored hay and dry calf grains.
9. Milk can be discontinued by 3 or 4 months of age or possibly sooner if the kid is eating hay and grain well. The majority of the feed will need to be grain as stomach size is very limited at this time.
10. Identify every kid with a tattoo number at an early age because identity can be lost when there are numerous kids penned together.
11. Keep all feed troughs and feeding equipment clean or there will be digestive upsets and scours.
12. Be careful not to overfeed or underfeed as this can cause digestive problems.

Further information on feeding may be obtained by talking with others who raise goats. Remember the appearance of the animal, vitality, production of milk, and the growth of young kids and yearlings are all important measures of your feeding program.

Feed Records - If careful records are kept of your feed costs, you will be better able to plan on how to cut these costs. A good goat herdsman is also a good manager and businessman. He is interested in making his income more than offset his expenses. Unless one gets ahead financially, he will usually not be able to take the necessary steps to have a more efficient herd. In some cases, one excellent milk producer can take the

place of two small producers and the saving is not only in feed, but in the extra labor of caring for one additional animal. Feed records do tell an important story.

Growth Records - Do your kid goats gain a quarter of a pound daily or a half pound? For added interest, get a dairy goat tape from your feed dealer and estimate weight gains every two weeks or a month. If you want to be very exacting, get a small scale. Curves can be plotted on a gain basis with pounds on the vertical axis and time in days, weeks or months on the horizontal axis. Use graph paper for this. You will be surprised at how differently animals gain. A young animal that doesn't grow well should have its feed program checked over carefully and be examined for parasites or disease. Growth records are a check on your management.

Feed Tables - What is in Feeds? These tables of the composition of feeds are useful to those who have a particular interest in the average protein, energy, calcium, phosphorus and carotene or pro-vitamin A content of feed ingredients. The analysis may not be exactly the same as roughages you grow because of the differences in soils, fertilization, weather conditions, etc. The tables are rather average compositions which can be used as a guide if you are home mixing feeds.

COMPOSITION OF FEEDS¹

Feeds ²	Dry	Digesti-	Total	Calcium		Phosphorus		Caro-
	Matter	ble Pro- tein	Digesti- ble Nitro- gen	%	Gm./Lb.	%	Gm./Lb.	tene
	%	%	%	%	Gm./Lb.	%	Gm./Lb.	Mg./Lb.
<i>Air-dried forages:</i>								
Alfalfa hay, average	90.5	10.3	50.3	1.47	6.97	0.24	1.09	11.4
Barley hay	90.8	4.0	31.9	0.26	1.15	0.32	1.04	...
Barley straw	50.0	0.7	42.3	0.32	1.45	0.11	0.60	...
Clover hay, crimson	89.5	9.3	48.9	1.23	5.69	0.24	1.09	...
Clover hay, red	88.1	7.1	52.3	1.53	6.12	0.19	0.88	8.6
Corn fodder, very dry	91.1	3.8	58.5	0.24	1.09	0.16	0.72	1.8
Corn stover, very dry	90.6	2.1	51.9	0.29	1.32	0.06	0.22	...
Cowpea hay	90.4	12.3	51.4	1.57	6.22	0.29	1.32	...
Kafir fodder, very dry	90.0	4.5	23.6	0.35	1.59	0.18	0.82	2.0
Lespedeza hay, average	89.2	6.4	47.5	0.98	4.45	0.18	0.82	23.4
Oat hay, moderately green	88.1	4.9	47.3	0.21	0.95	0.19	0.86	3.0
Oat straw	89.7	0.7	44.7	0.19	0.86	0.10	0.45	...
Prairie hay, moderately green	90.7	2.1	49.6	0.36	1.63	0.18	0.82	9.3
Red canary grass	91.1	4.8	45.1	0.85	1.30	0.16	0.73	...
Sorghum fodder	88.8	3.3	32.4	0.34	1.54	0.12	0.54	1.1
Soybean hay	88.0	9.6	49.0	0.94	4.27	0.24	1.06	...
Sudan grass hay	89.3	4.3	45.5	0.86	1.63	0.36	1.13	2.9
Timothy hay	89.0	3.9	48.9	0.23	1.04	0.20	0.91	3.3
<i>Silages, roots, tubers:</i>								
Alfalfa silage, slightly wilted	26.0	4.1	21.3	0.51	2.32	0.12	0.54	14.9
Carrots	11.9	0.9	10.3	0.06	0.28	0.04	0.13	10.8
Corn silage, well matured, average	27.4	1.2	18.1	0.10	0.45	0.06	0.27	4.0
Sorghum silage, sweet	24.3	0.8	18.2	0.06	0.36	0.04	0.15	2.7
Soybean silage	24.8	2.9	14.8	0.34	1.54	0.09	0.41	14.6

(continued)

Feedstuff	Dry Matter	Dig-estible Protein	Total Dig-estible Nutrients	Calcium		Phosphorus		Case-ine
	%	%	%	%	Gm./Lb.	%	Gm./Lb.	
Grains, seeds, and by-product concentrates								
Barley	89.4	10.0	77.7	0.09	0.41	0.47	2.18	.....
Barley (Pacific Coast)	89.0	7.7	78.3	0.06	0.27	0.41	1.86	.....
Beet pulp, dried	90.1	4.3	67.8	0.71	3.22	0.12	0.44	.....
Beet pulp, molasses, dried	90.1	7.1	79.1	0.62	2.83	0.09	0.43	.....
Beet pulp, wet	11.6	0.8	8.8	0.09	0.41	0.04	0.04	.....
Brewers' grains, dried (16-20% protein)	92.3	15.8	61.8	0.29	1.31	0.48	2.16	.....
Brewers' grains, dried (23-26% protein)	92.9	22.1	87.1	0.26	1.14	0.49	2.22	.....
Blood meal or dried blood	91.8	80.0	81.2	0.36	3.90	0.50	2.27	.....
Citrus pulp, dried	90.1	2.8	78.2	2.28	10.35	0.17	0.77	.....
Coconut oil meal, suppler	92.6	17.4	80.8	0.12	0.56	0.82	2.91	.....
Corn, yellow, No. 2 equivalent	88.0	6.8	80.0	0.02	0.10	0.27	1.22	1.3
Corn and cob meal	98.1	5.3	73.2	.....	.....	0.22	1.00	.....
Corn gluten feed	81.1	22.9	76.2	0.49	1.82	0.62	3.72	6.1
Corn gluten meal	91.4	26.5	80.2	0.23	0.91	0.41	1.86	19.0
Cottonseed, whole pressed cake	88.6	20.3	66.8	0.16	0.66	0.77	3.80	.....
Cottonseed meal (38-42% protein)	92.2	34.2	73.8	0.18	0.82	1.14	5.18	.....
Distillers' corn grains, dried	92.9	20.7	82.4	0.23	1.04	0.80	2.72	.....
Hemlin feed	88.7	7.5	81.4	0.06	0.23	0.48	2.18	.....
Kaoli	89.6	9.1	80.7	0.04	0.18	0.38	1.80	.....
Linseed meal (32% protein)	91.2	30.4	77.1	0.44	2.52	0.94	4.26	.....
Linseed meal (37% protein)	90.9	33.0	77.5	0.49	2.22	0.96	4.03	.....
Milo	88.4	8.8	80.1	0.03	0.14	0.27	1.22	.....
Milkhead chupe	90.0	7.7	77.2	0.14	0.63	0.26	1.18	.....
Molasses, beet	82.5	4.4	60.8	0.06	0.36	0.02	0.09	.....
Molasses, cane	74.0	.....	24.0	0.74	3.38	0.06	0.36	.....
Oats	90.2	9.4	70.1	0.09	0.41	0.43	1.96	.....
Oats (Pacific Coast)	98.2	7.0	71.4	0.09	0.41	0.48	1.96	.....
Peanut oil meal (43% protein)	92.7	39.2	82.0	0.16	0.73	0.54	2.48	.....
Rice bran	81.0	8.7	89.4	0.08	0.36	1.36	6.17	.....
Rice polish	90.2	9.6	82.6	0.04	0.16	1.10	4.99	.....
Rye	89.6	9.9	78.1	0.01	0.04	0.33	1.50	.....
Soybeans	90.0	57.7	87.0	0.27	1.22	0.62	2.81	.....
Soybean oil meal (hyd. or exp.)	90.6	36.2	78.7	0.28	1.27	0.61	2.77	.....
Soybean oil meal (solvent extracted)	91.6	42.4	78.4	0.28	1.22	0.63	2.86	.....
Wheat	83.0	12.8	79.8	0.85	0.22	0.41	1.96	.....
Wheat (Pacific Coast)	82.2	8.8	80.0	0.06	0.22	0.29	1.22	.....
Wheat bran	89.7	13.3	66.4	0.14	0.63	1.30	5.90	.....

Table from National Research Council
(Recommended Nutrient Allowances for
Domestic Animals)

MANAGEMENT PRACTICES

Buck kids should be separated from doelings at 2-4 months of age or some of the females will be bred too early, thus stunting their growth.

Exercise

All kids, yearlings, and bucks should be penned separately and allowed a yard where they can exercise. Kid yards should be on the south side of the building to make use of the added warmth and sunshine. Boxes, rocks, old stumps and other elevated objects placed in the middle of the yard away from fences will be useful for the animals to run and jump on.



Managing the Buck

Don't house the buck near your neighbors as this may cause trouble. Bucks should always be housed at least seventy-five yards away from the milking animals because of undesirable odor which can very readily be absorbed into the milk at milking time or be rubbed off onto the doe with contact.

The buck should be clipped underneath and washed with a strong disinfectant if his odor becomes too objectionable. His pen should be cleaned and disinfected at regular intervals to help control odor.

Be sure he has a sizeable yard for exercise and at least a 5 foot high, well constructed fence around the yard. Some bucks that continually get out may be kept in with an offset wire about 12 inches out from the inside of the top wire. If he tries to jump, this offset wire will knock him down.

Bucks which do not get adequate exercise may become sterile. Bucks raised together may not fight enough to injure one another when housed together. Use your judgment, they will get a lot of exercise playing if they are not violent enough to hurt each other. Strange bucks will fight and may kill each other.

Place a small metal barrel in the buck pen so he can push it around with his head for exercise or string a wire across the pen and suspend a piece of wood for him to push around. Have it planned so he cannot get entangled in the support wire.

To Tether or Not to Tether

Some good producers say never to hitch an animal out as it may become entangled and choke to death. A tethered animal is at the mercy of dogs. Fences are probably safer, even if more expensive. The real answer may depend on whether you will be nearby to watch the animal and whether the animal is the nervous flighty type or has a quiet disposition. Use your judgment.

List of Goat Equipment

1. Electric dehorner
2. Ear punch for putting in ear tags
3. Self-piercing ear tag instrument
4. Rotary tattoo
5. Ferrrier's knife for trimming feet
6. Knife
7. Elastrator
8. Hoof trimmers
9. Emasculator
10. Emasculatome
11. Dose syringe for drenching
12. Curry comb
13. Brush



Dehorning Kids

The best dehorning instrument is to use a naturally polled buck on your does that is homozygous for polled character. In other words, this male never throws horns on his offspring. Since this isn't always possible, dehorning will be discussed. Many kids can be dehorned at about a week of age. Don't wait until a solid horn is evident or treating may stunt horn growth and produce a disfigured horn.

1. Use an electric dehorning device - The end of the electrically heated dehorner should be from 3/4 inch to one inch in diameter--preferably one inch for male kids. Plug the iron in and heat it to a cherry red. Restrain the kid and apply the iron to the horn spot for 10 to 15 seconds or until the area is a copper red. This should destroy the horn cells. Apply a carbolated vaseline to the spot and release the animal.

2. Chemical methods of dehorning - You can purchase potassium hydroxide in stick form at the drug store. This material should not be used by children or stored where children can handle it as serious burns are possible.

First, cut the hair from around the horn area. Wrap paper around the caustic stick to protect your hands and dampen the stick by dipping the tip in water. Restrain the animal and apply the caustic stick with a circular motion until the horn tissue is burned off in a circle about one inch in diameter. Usually the area will appear pinkish white. There may be drainage from the area, so put vaseline around the burned spot and down the side of the head so the face will not be burned. Goats should be penned separately for a day or so after the operation or they may burn each other with the caustic from the treated area. Do not let these treated goats nurse their mothers or burned udders will result.

3. A dehorning paste may be purchased from livestock supply houses and probably is safer to use than the potassium hydroxide stick mentioned above. Here again, the treated animal should be kept separate from others for a day or two.

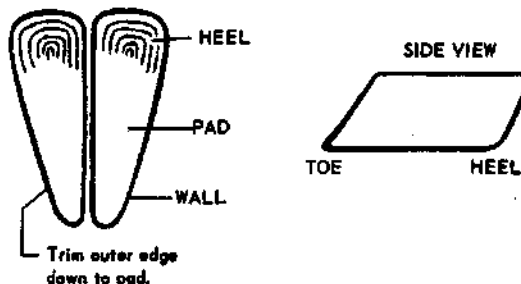
Get the job done before the fly season starts. Mature goats can be dehorned but probably this should be done by a veterinarian who can use nerve blocks so the animal will not suffer unduly. Usually a small wire saw is used and the bleeding is lessened by the saw blade closing off and crushing the ends of the blood vessels. Pine tar will help disinfect the area and keep the flies away. Special elastator bands may be used to dehorn goats.

Whenever possible milking does should be dehorned in the latter part of the lactation period as the milk flow will be decreased by the operation.

Hoof Trimming

Animals housed on soft moist bedding away from cement or asphalt yards, ledges, and rocks have less wear on hoofs and will need hoof trimming regularly. Unless feet are kept properly trimmed, a foot can become deformed. Foot bones thrown out of line by a lack of hoof care can cause an animal to go lame and may mean the shortening of an animal's productive life. Check the hoofs once monthly. Animals travelling in wet areas can have their feet trimmed much easier. Dry hoofs are hard and difficult to cut. Always trim the feet of show animals no closer than a week or ten days prior to the show so an injury will not mean a lame goat going into the show ring. Trim several times prior to show.

Tools - Sharp pruning shears are handy to cut toes down. The author prefers a pruning shear normally used on shrubbery that has a blade that cuts directly onto a lower support padded with a soft metal. Sharpen your shears before you start. A sharp jackknife is a good tool. A blade that locks open is more desirable from a safety standpoint. A ferrier's knife which doesn't have a sharp point is ideal. It can be purchased through livestock supply houses. The illustrations should be helpful.



Positions for Hoof Trimming

1. A stanchion to hold the animal's head is desirable. A milking stand is probably too high off the floor although the front feet could be done on the stand. Even hind feet can be done this way if the stand is low enough. The author likes to put the animal's leg between his to help control the hind legs.

2. Another position is to tie the animal's head in the corner of a rail or board fence. Tie a light rope on the rail in front of the animal's chest or bring it back on the outside of the body and tie it to the rail in back of the animal so it cannot shift positions easily. It will be necessary to retie the animal to do the other side. This is a time consuming method.

3. Still a third position is to set the animal up on its rear end in a well bedded pen with your left arm under the front legs. The head will hang to one side. This is called shearing position and is commonly used in trimming the feet of sheep. Each foot is then trimmed separately. All four feet can be trimmed from one position. This is a quick method.

Procedure - Take your pruning shears and cut off any bent-over portions of the hoof. This will expose the bottom of the foot. Now smooth the bottom of each half of each hoof by cutting with the knife from the heel of the hoof toward the toe. Until you gain experience, don't go too deeply or you will hit the blood supply. The color of the hoof will become pink as you near the blood supply. Now, by examining the toe from the bottom, you can see where the long toe should be cut off. Do this with the pruning shears.



Untrimmed Foot

Half Trimmed Foot

Trimmed Foot

After you have become accustomed to your goat's feet, you will notice that hoof structure varies a bit with different animals. The blood supply is nearer the surface with some animals than others. If you hit the blood supply, don't panic. It is not a bit unusual to cut a little

too deeply. Apply direct pressure on the cut area with a clean cloth for a half minute or so to allow clotting. Usually this will stop the bleeding. If you get too deep with the knife and there is spurting of blood, take some sanitized, long-nosed pliers and squeeze the blood vessel. This will usually stop the blood flow. A serious injury to a foot in hoof trimming is very uncommon, so trim the feet regularly.

Tattooing and Ear Tagging for Identification Purposes

Tattooing is done with an instrument which may be purchased from livestock supply houses. It is an instrument which looks like a pair of pliers into which numbers or letters can be inserted. Each number is outlined with sharp needle projections. Tattooing can be done in the ear being careful not to hit the ridges in the ear or it can be done in the soft tissue on one side of the tail. First, clean the area with a cloth, check the tattoo machine with proper numbers in place on a piece of paper to be sure correct numbers are printed. Print the cleaned area with the number and rub tattoo ink into the holes with the finger.

Ear tagging - This method of identification of dairy goats is not being recommended and is unpopular because many goat owners have seen a valuable but inquisitive animal catch the tag on a fence or brush and rip the ear, thus disfiguring it.

If ear tagging is done on commercial goats, care should be taken to place the tag about one inch from the head on the top of the ear where it can be easily read. Use either an ear punch or a self-piercing tag, preferably the ear punch because there is more room around the tag after healing so the ear is not so sensitive. See illustration on page 48 showing the different marking instruments. Tattooing is much preferred to ear tagging.

By all means, have your animals properly marked for easy identification both at home and at shows. Records made on a name basis with no method of tying the name to the record in a positive manner may lose you some sales. Never buy purebred goats from a herdsman who doesn't have positive identification on the animal. He may be careless with pedigrees also.

Castration

Buck kids that are not to be retained for breeding should not run with the herd beyond two to four months of age. Well fed animals mature earlier and may breed the young females. If older bucks are to be used for meat purposes, they should be castrated at an early age or there will be a taint to the meat and the meat will be less tender.

The earlier male kids are castrated, the less shock to the animal. Get the job done as soon as the testicles descend into the scrotum. This time may vary from 7 days to 3 weeks of age.

When cutting instruments or the elastrator are to be used, do the job before fly season and preferably before warm weather sets in. Animals to be castrated with a cutting instrument should not be excited

because the heart beats faster and there may be more blood. The instruments for castration, other than the knife, cost from \$16.50 to \$30.00. Associations or clubs could own instruments jointly and loan them, thus cutting costs.

Methods

1. Elastration - The elastrator is an instrument which looks like a pair of pliers for expanding a special rubber ring so it can be placed over the testicles. Sit down, hold the kid on your knees, push the testicles into the scrotum by pressing on the belly wall with the left hand and slide the hand toward the scrotum. With the right hand, expand the ring, slip it over the testicles, but below the rudimentary teats, being sure both testicles are present before releasing the ring. Glands will drop off in ten days or two weeks. The animal will show discomfort for about an hour. This is a bloodless operation.

2. Use the Emasculator - This is a heavy, long handled, cord-crushing instrument. The operation is bloodless. It is placed above each testicle, but below the rudimentary teats. Crush each cord separately and leave the instrument on about 10-15 seconds. Do the second cord below the first one. The scrotum or sac remains on the animal, but testicles dry up as the blood supply doesn't get to the glands. This is a bloodless operation, is safe to use in fly season and the animal will show less shock than with the use of the elastrator. Old animals may be done with this instrument, but will show more shock than younger animals as the cords and blood supply are further developed. There may be some animals that don't get castrated unless great care is used with the instrument.

3. The Knife - It is the surest method, but involves a small amount of blood. There seems to be less shock when a knife is used. Sanitize the lower 1/3 of the scrotum and the knife with a mild disinfectant. Have someone sit down, hold the kid on the knees on its back with the legs secured by the hands of the holder. The lower 1/3 of the scrotum is cut off exposing the two testicles. With disinfected hands, draw each testicle out slowly, cord and all. If the animal is older than a month, scrape the cord with a dull knife until it is severed. There will be several drops of blood. Place the animal, if young, back with its mother in a clean, well bedded pen to prevent infection and possibly tetanus. Mature bucks can be done too, but instead of scraping the cord off, use an instrument called the emasculator which has a crushing edge on the upper side of its blade and a cutting edge on the lower side. The crushing pinches off the blood vessels so there is less bleeding. Don't use a knife during the fly season and don't use a knife unless good sanitation is practiced. It is safer, as there is more blood, to get a veterinarian to do the castration on older animals.

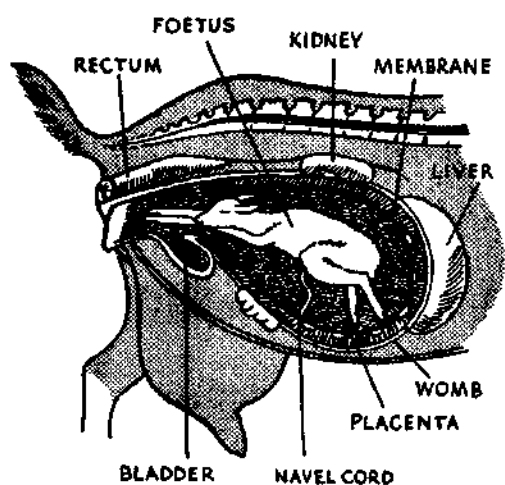
What to do at Kidding Time

About 150 days, more or less, after breeding, the doe will be ready to have her young. The udder will contain milk 3 - 4 days prior to kidding

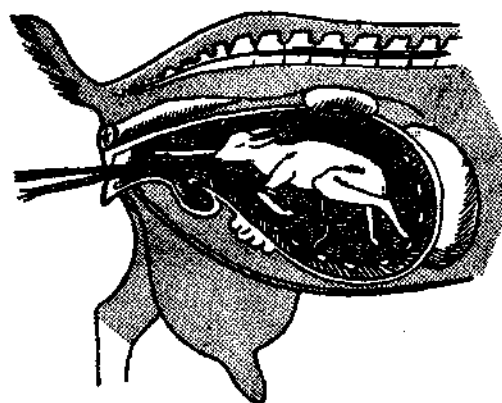
and sometimes earlier. If the udder becomes painful to the doe, she may be milked. The first milk after kidding contains needed nutrients for cleaning out the digestive tract, Vitamin A to build resistances, it develops antibodies against disease, and contains the necessary energy to give the young a good start. It is called colostrum.

Prepare the kidding pen by cleaning, disinfecting and using fine bedding so the kids will not become entangled. Keep water pails high enough off the floor so the kids will not be dropped in the water to drown. The day before kidding, substitute part of the grain with a warm wet bran mash which is laxative and will clean out the digestive tract, thus making less competition for the room in the vagina area. Pen the animal and let her alone.

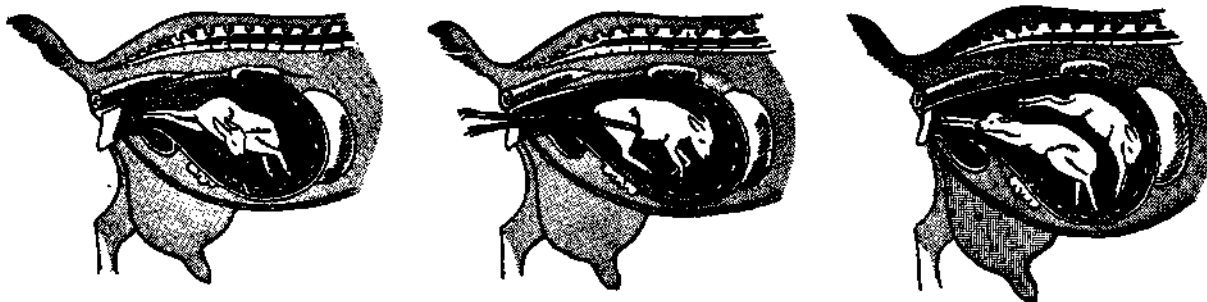
Symptoms of kidding are uneasiness, bleating, pawing, etc. After the mucous discharge lubricates the passage and the placental sac breaks, the kids are usually born within an hour. Check the doe at half-hour intervals and give her every chance to kid without assistance. If she strains for over an hour and a half with little success, sometimes it helps to place bedding or a sack half filled with sawdust under her hind legs or rear end, if she is laying down, so the front end is down hill. This may help kids to get properly lined up for presentation. The very large majority of the kids will be born without assistance. Study the illustrations to learn positions so you can help if needed. The normal position is for the head to be on the front legs. Sometimes the hind end comes first. If the head is back or one or both front legs are down, you will need to help.



Normal Presentation



Bring the Leg Forward



Push the kid back
and raise head onto
front legs

Push the kid back
until the rear legs
can be raised

Normal for Twin birth

If you assist, tie the doe's head to a wall ring or place the neck in a stanchion. Wash arms and hands with warm, soapy water containing a milk disinfectant, being sure the fingernails are short. Insert the lubricated hand and explore the position of the kids. Don't pull on anything until the doe strains and be careful that you know what you are pulling on. Be gentle and guide the front legs and head toward the passage and let nature take its course. If you use a cord as shown in the drawing, a 1/4 inch nylon cord is smoother than other ropes. The sack under the legs or rear end should be removed at this stage.

Sometimes, old goats or animals in high condition seem to act like they were about to kid, but don't. Assist them by elevating the front feet. If they don't kid, cleanse and lubricate the hand and check the birth canal. If your hand can enter, the doe should kid. Sometimes the cervix does not dilate and a veterinarian's assistance is very necessary.

The afterbirth will usually be passed in 30 minutes to 4 hours after the kids are born. If this does not happen within six hours, call the veterinarian.

It is good practice to dip the navels of newborn kids in a dilute iodine solution. It should be in a large mouth jar so the cord can be dipped clear to the belly of the kid. Undesirable organisms sometimes enter the kid through the cord shortly after birth.

Water and Feed the Doe

After kidding is over, the doe will appreciate a warm pail of water to replace lost body fluids. Allow her to rest at this time. When she is hungry, allow her hay and about 1/3 to 1/2 of her usual grain feed - warm bran mash is preferred. Watch her closely and increase the grain slowly as she can handle it. It will usually take two weeks to get the doe on feed.

Metritis is inflammation of the vagina and birth passage. The infection can cause a fever. It is not uncommon, especially if a doe has been assisted with the birth of her kids. Call the veterinarian. He usually gives the animal an antibiotic shot and places a medicated capsule in the vagina.

GOAT DISEASES

Internal Parasites

Of all the internal parasites of goats, the roundworms are economically the most important. The majority of the roundworms have a direct life history. Eggs are laid by the mature worms while in the stomach or intestines of the goat; the eggs pass out with the droppings and hatch on pasture into infective larvae. The eggs hatch in a few days or a few weeks, depending on moisture and temperature conditions. The larvae must go through a maturation stage of from two to ten days after which time they crawl up stalks of grass in the pasture and are ingested by the new host goat. The young worms reach maturity in about two to six weeks and begin laying eggs again.

Animals become infected by grazing on pastures seeded with droppings from infected goats, so young kids and adults should be grazed on separate pastures. It is highly desirable that separate summer and winter pastures be used for all animals. In many areas of the United States, the parasite carry-over can be markedly reduced by resting the pastures over winter. Newly purchased animals should be treated for internal parasites and confined away from the rest of the herd for at least a week. Isolation for an additional week will help prevent outbreaks of other disease problems.

Symptoms

The first signs of parasitic infection are general unthriftiness, a rundown condition, and rough haircoat. Animals lose weight, appetite is either poor or lacking, diarrhea is often present, and the goats may be in various stages of anemia manifested by a paleness of the lips, tongue, and mucous membrane of the eyes. Sometimes a swelling is noted beneath the lower jaw and a chronic cough may be present.

Treatment

A fecal sample from each goat should be taken to the veterinarian for examination to determine the type and degree of infestation. Then treat accordingly.

Thiabendazole is effective against a wide range of internal parasites. It does not taint the milk and is safe for use with all ages of goats when used as directed. Treatment may be necessary on a monthly basis during the hot humid months. If possible, keep the animals out of their pasture for 3 to 4 days after dosing to reduce reinfestation by the parasite eggs that are expelled.

Levamisole (a trade name is Tramisol) is a new anthelmintic currently approved by the Food and Drug Administration for use in sheep, cattle and swine but it is not yet cleared for goats. Experimentally, however, it has been found just as effective in goats as thiabendazole and in addition is effective against the large lungworm. Contact your veterinarian occasionally to learn when this new drug is approved for use in goats.

Coccidiosis

Coccidiosis is caused by a microscopic protozoan which inhabits the intestinal tract. Symptoms include extreme thinness, lack of appetite, and diarrhea which is often blood-tinged. A specimen of the bowel movement should be examined by a veterinarian to determine whether these organisms are present.

Good sanitary management is necessary in the control of coccidiosis. Young kids should be kept in well-lighted dry pens. Movable shelters which are frequently moved to clean dry areas are preferable to permanent barns for kids. Sunlight is one of the most effective coccidiostats available. Treatment involves use of sulfa drugs, nitrofurazone or antibiotics followed by careful nursing. These products may also be used prophylactically in low concentrations in feed or drinking water.

Lice

Lice are of two types, those that attach themselves to the skin and suck the blood and those which are called biting lice and live on scales, hair fibers, and skin debris. They spend their entire life cycle on the goat. Affected animals may be treated for lice by either spraying or dusting. Spraying is most effective.

Control of Lice on Lactating Goats (Care should be taken to avoid contamination of milk or milking utensils with insecticide.) Spray for complete wetting to run-off. Co-Ral (coumaphos) - 0.03% (in water), 4 tbs. of 25% Co Ral WP or 8 tpsps. of 1.1 lb. Co Ral/gal. emulsifiable concentrate in 4 gal. of water.

OR

Ciodrin - 0.25% (in water), $\frac{1}{2}$ pt. 1.1 lb. Ciodrin/gal. emulsifiable concentrate in 4 gal. of water. Spray animals thoroughly with up to 1 gal. of 0.25% spray. Apply second application 14 days later. Repeat as needed, but not more often than once every 7 days.

Demodetic mange - References on page 76.

A minute spindle shaped mite, Demodex caprae, is responsible for a disease termed demodetic mange in goats. The mites live deep in the skin where they give rise to soft oval blebs which range in size from $\frac{1}{8}$ " to 1" in diameter. These are usually smooth-surfaced but may rupture, in which case the skin can become secondarily invaded by bacteria which produce small abscesses. Blebs are most commonly found in the axillary area (under the legs) but may occur along the neck, legs, face or flanks.

Gross symptoms of demodetic mange are rarely present before one year of age. Once acquired, goats may show symptoms for at least as long as nine years. We do not as yet know exactly how the disease is acquired but suspect direct transference from mother to young during nursing.

Positive diagnosis may be made by puncturing the bleb and squeezing out the toothpaste-like contents. This material is spread on a slide using a drop of clear machine oil and examined under the microscope. Mite eggs, larvae, nymphs and adults should be readily apparent if these are the causative agents. Tick bites, small warts, scar tissue from wounds, etc. often appear similar to demodetic blebs, but obviously do not contain the mites.

Treatment - As soon as demodetic blebs are noted, they should be cut carefully in cross pattern with a sharp knife, the contents expressed, and the cavity painted with formalin or iodine.

Such palliative treatment does not assure a cure but prevents increase in size of the incised blebs and may cut down the possibility of mite transference to other animals. Constant vigilance is needed since other blebs will probably arise on the same animal.

Fortunately, demodetic mange poses no marked economic threat. Healed blebs do cause blemishes in the hide and show animals are often disqualified in competition. So far we have found no relationship between management practices and demodetic mange.

Mastitis

Mastitis is an inflammation of the udder caused by various types of bacteria. Predisposing causes include failure to keep bedding clean, bruises from nursing kids, cuts or scratches on the udder or teats or possibly infectious discharges from the uterus which may run down over the bag. The first symptoms noticed might be a straddling walk on the part of the doe and failure of the kid to nurse. The udder is usually hard, hot and swollen, and flecks or slugs may be noted in the milk.

The animal should be isolated from the herd and hot packs applied in the form of towels soaked in epsom salts water as hot as the hand can stand. This should be repeated four to five times daily; after soaking, the udder should be carefully dried and then milked out. Following the milking out, the udder should be gently massaged with camphorated oil. Your veterinarian may also suggest infusing the udder with antibiotics and should be called in such cases.

Foot Rot

Foot Rot is not seen very often in dairy goats, but it may occur in animals that spend much of their time in wet unsanitary yards or barns, or stand in wet bedding constantly. The first symptoms noted will be lameness followed by a swelling of the foot which becomes hot to the touch.

In treating, all dead tissue should be pared away with a knife and the foot soaked in a saturated solution of copper sulfate (2½ lbs. per gallon of water) for one or two minutes. Bacteria are usually involved and your veterinarian may recommend the use of one of the broad spectrum antibiotics as a supplementary treatment. The copper sulfate solution is deadly poison so be careful where you dispose of it.

Brucellosis

The infection in the goat is caused by the germ, *Brucella melitensis*. Symptoms: abortion, lameness, inflammation of udder and reduced milk flow. All dairy goats should be tested for this infection as it can cause a serious disease in humans called undulant fever. A human can contract the disease not only from the unpasteurized milk, but from assisting at kidding time if the disease is present. The organism can gain entrance through a break in the skin. Follow state and local regulations as to the pasteurizing of milk. There have been very few cases of this disease in recent years in dairy goats in the United States, but it is wise to blood test the goats anyway.

Bloat

Bloating is the accumulation of excessive amounts of gas in the rumen. This may result from overeating tender, young, high moisture content legume pasture or eating lush, green forage that is still wet with dew. Occasionally bloating may follow choking caused by apples, corn cobs or the like. Bloat causes a swelling in the triangle formed by the left hip bone, the end of the rib cage, and the top of the loin. The animal will show distress, lying down and rising, kicking at the abdomen, slobbering and grunting.

Prevention consists of making sure the animals have a good feed of dry hay before turned out on a moist, young pasture. A grass-legume pasture should be used rather than straight legumes. Treatment should be by a veterinarian and consist of introducing antiferments by a stomach tube or drench. Animals die very suddenly with bloat, so don't wait before calling for assistance.

Constipation

Kids occasionally show symptoms of constipation. The owner may note indications of straining and difficulty in attempting to pass feces. Droppings are very hard and dry. This may be the result of overfeeding normal rations or due to coarse dry indigestible feeds. A lack of sufficient exercise or water also contributes to this condition. Change the feed to a more laxative type, keep clean water available, and give the animal more exercise. If this does not correct the condition, a warm soapy water enema is indicated. Occasionally laxatives must be given in the form of a teaspoonful of castor oil for a weanling kid or one to two oz. of epsom salts dissolved in a pint of warm water.

Diarrhea

In kids, bacterial scours occurs usually during the first few days of life and may result from chilling, unsanitary environment, or faulty feeding practices. The signs include liquid feces, weakness, and depression. Unless treated, death may occur within 24 hours.

The newborn should always receive colostrum milk for the first two or three days. If hand feeding follows, strict cleanliness of equipment is necessary, even sterilization of feeding containers whenever a problem exists. At least three feedings per day are recommended with either milk or a milk replacer. A milk replacer low in lactose and containing antibiotics may help prevent the occurrence of dietary scours. If such scouring begins, skip a feeding and dilute the milk replacer for the next few feedings. Then if the diarrhea persists, consult a veterinarian about the use of suitable medication.

In older animals, diarrhea may be due to intestinal parasites, coccidiosis, Johne's disease or other causes such as a sudden shift from dry feed to lush green pasture. Gradual changes in the feeding program is always recommended. Scouring may appear in grazing animals after the first heavy frost, but usually subsides in a short time.

Ketosis

Ketosis is a metabolic disease occurring just before, or two to four weeks after kidding. The first symptoms of the disease are twitching of the ears, muscular spasms, and loss of appetite. As it continues, coma develops with rapid labored breathing, frequent urination, and finally death. An unbalanced diet, sudden changes in the diet, or underfeeding during advanced pregnancy is thought to be the cause.

Treatment in the form of intravenous glucose and intestinal stimulants are of some use but prevention is the real answer. Does should be given a diet containing good green alfalfa or legume hay and at least a half pound of grain containing corn. Feeding should be done at regular hours and no abrupt changes made in the diet. A moderate amount of exercise will tend to keep the body toned up and the animal from going off feed.

Milk Fever

If the goat is a heavy milker, milk fever may appear soon after kidding. It is caused by a lack of availability of calcium salt. Early symptoms are loss of appetite followed by restlessness, excitement, trembling of the muscles, and the goat may fall repeatedly until she finally goes into a coma and dies.

The animal should be propped up on her breast bone and kept warm with blankets or bedding. Calcium salts should be injected by a veterinarian intravenously. Heavy milking does should be fed mineral mixtures, free choice. Never attempt to drench the goat for milk fever since the throat is usually paralyzed.

Poisonous Plants

Poisonous plants may be troublesome when goats are confined in small wooded areas where edible browse is soon consumed. Then goats start eating other plants which may be poisonous because the feed supply is short. Such poor management may result in the death of goats.

If goats show signs of distress under such conditions, call the veterinarian immediately. Try to identify any suspicious plants before the veterinarian arrives so he can possibly devise an antidote.

Among the poisonous plants are the following: False hellebore, buttercup, cowslips, dutchmans breeches, water hemlock, mountain laurel, sheep laurel, sneeze weed, white snakeroots, bracken fern, wilted or dry wild cherry leaves and dry oak leaves.

Ornamental shrubs such as rhododendrons and yews are very poisonous. Foxglove, delphiniums, lobelia, and lily-of-the-valley are also dangerous. This is an incomplete list. Reference - page 77.

D. N. Stern, D.V.M., author of the original Disease Section of this publication is on sabbatical leave at the time of reprinting of this publication, so the Disease Section has been edited by W. K. Harris, D.V.M. of the Veterinary & Animal Sciences Dept., Univ. of Mass. including an original contribution on the management phases of Diarrhea by Ivan L. Lindahl, Leader Sheep Nutrition and Management Investigations, U.S.D.A., Beltsville, Maryland.

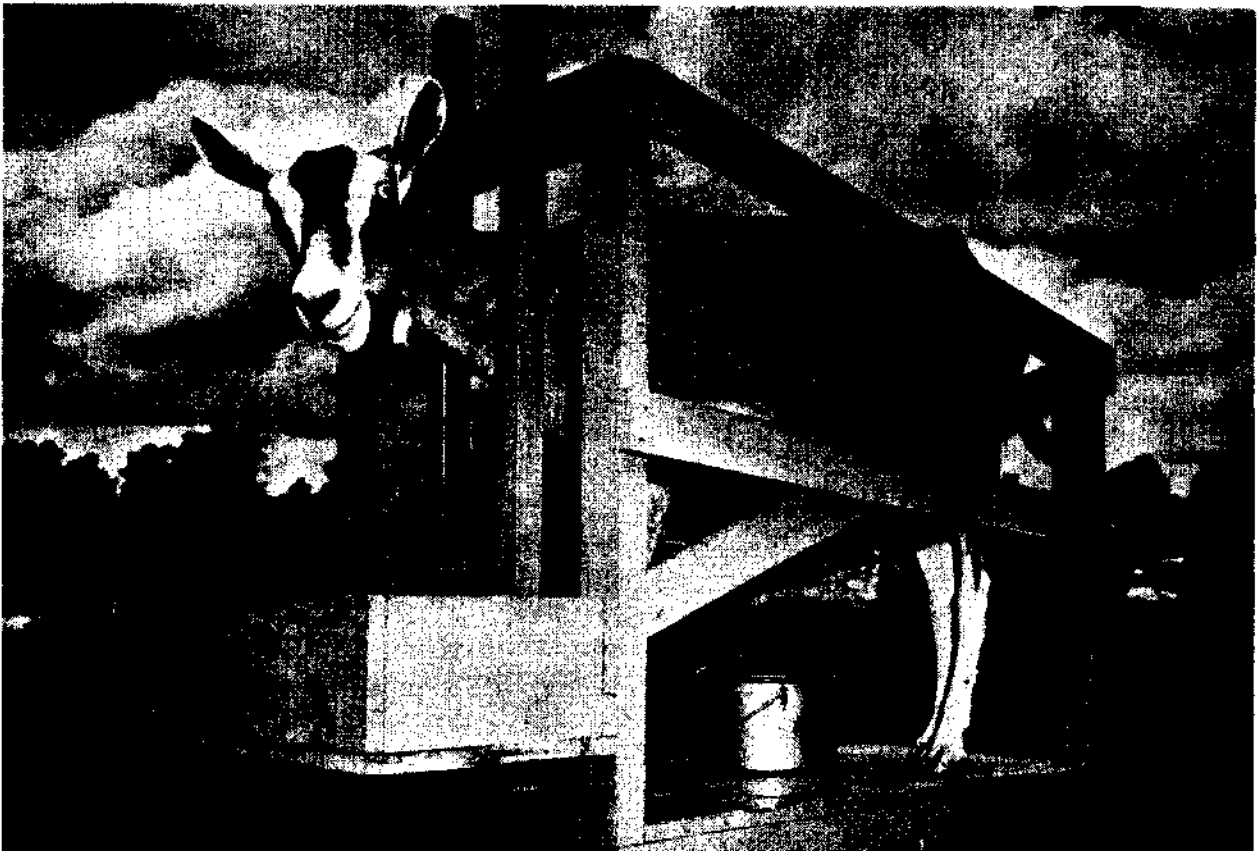
MILKING

Milking Procedure

Goat's milk is a nutritious, appetizing food, and as is the case with every food product, every precaution should be taken to insure that it is produced under clean conditions in order to maintain a low bacteria count and insure its healthful properties.

Proper milking procedure is one of the factors which can insure the purity of the product. Following are the steps that are recommended for the sanitary production of goat's milk:

1. Never feed strong flavored feeds such as onions, cabbage, or silage within four hours of milking. Feed these feeds after milking or the milk will pick up tastes and odor.
2. Clip the udders and flanks at regular intervals to prevent hair and pieces of bedding and other foreign material from gaining possible access to milk during milking.
3. Lactating goats should be milked in a clean room separated from other portions of the barn by a self-closing door as milk easily absorbs odors.
4. The room used for washing milking utensils must be kept separate from the milking and barn areas.



5. Prepare the goats for milking by washing the udder with lukewarm water containing iodophor or quaternary ammonium sanitizer. Make certain that a separate single service paper towel is used for each goat and that these are discarded in a refuse bucket after use. Do not use cloths or sponges for washing udders. Washing udders also aids in stimulating milk letdown.

6. The first three or four streams of milk from each teat should be milked into a strip cup. This is to detect flaky or stringy milk which may indicate mastitis. Any milk showing these signs must not be used for human consumption, and must be withheld. Also, use of the strip cup will aid in detecting off-colored milk.

Any goats which are suspected of having mastitis should be checked by a veterinarian for proper diagnostic treatment. If any goat is treated for mastitis, the milk from that goat must not be used for human consumption until the condition clears and until such time as all traces of medicines used have disappeared from the milk.

7. The dairy goat is most easily milked on a milking stand (see plan). A seamless, stainless steel or well-tinned pail should be used because it is most easily kept clean and sanitary. More desirable than an open-top pail is one which is partially covered or hooded.

8. The doe should be milked with clean, dry hands with care being taken not to permit the milk to come into contact with the hands.

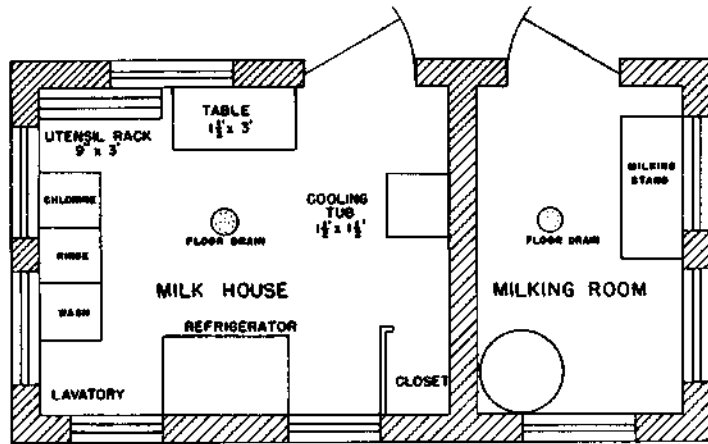
9. When milking is completed, the milk should be strained through a strainer of sanitary construction into a milk can. Strainer pads should be single service and should be changed when sediment is visible on the surface of the pad.

10. After straining, the milk should be cooled in an immersion or spray-type water cooler. If an immersion cooler is used, the level of water in the cooler should be maintained level with the milk in the can but not high enough to allow water to enter the can. If a spray cooler is used, the water jets should be adjusted to strike on the can shoulder without resulting in splashing that would permit water to enter the can. Water temperature in the cooler should be maintained about 33 to 35°F. for adequate cooling. Proper cooling is the most practical means of preventing bacterial growth after milking. The milk cooling facilities and cooled milk must be kept in a room separate from the barn and/or the milking area.

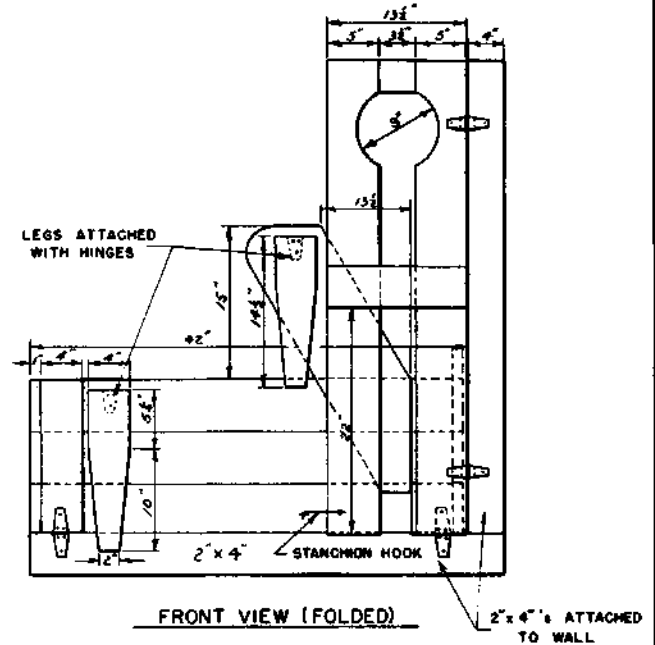
11. The buck goat, because of his odor, should be housed separately from the does, preferably in another building in order to prevent absorbed odors in the milk.

12. Diseased goats or does in maternity must be kept separate from lactating does.

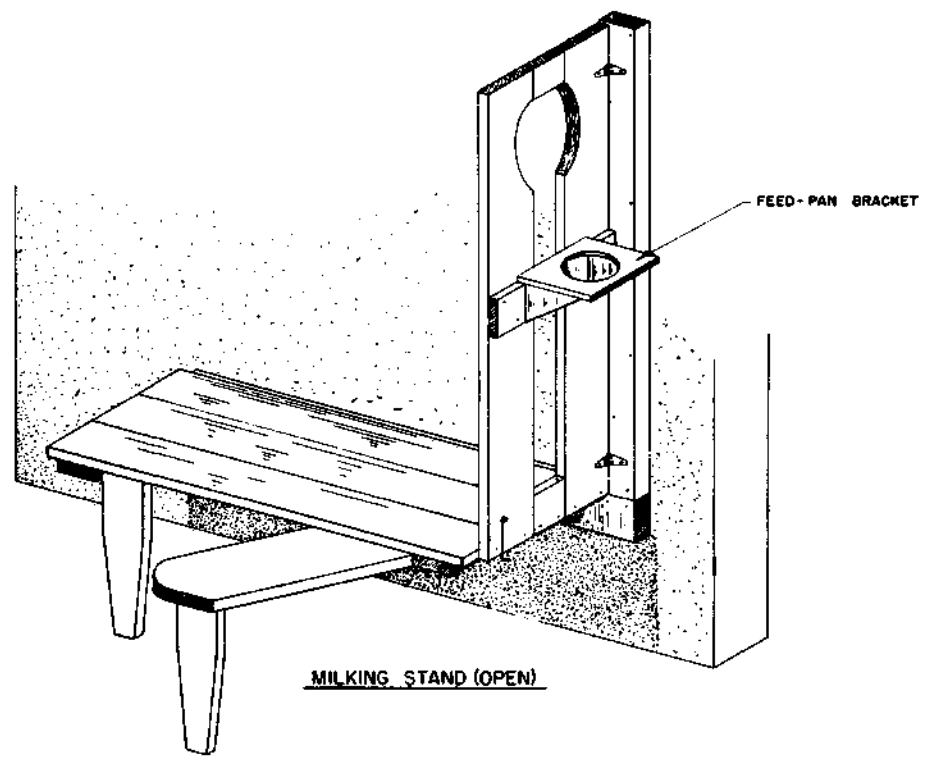
13. Any goats having signs of mastitis should be milked last. Take great care not to spread the disease to other goats by contact through contaminated bedding or improperly sanitized hands.



FLOOR PLAN



FRONT VIEW (FOLDED)



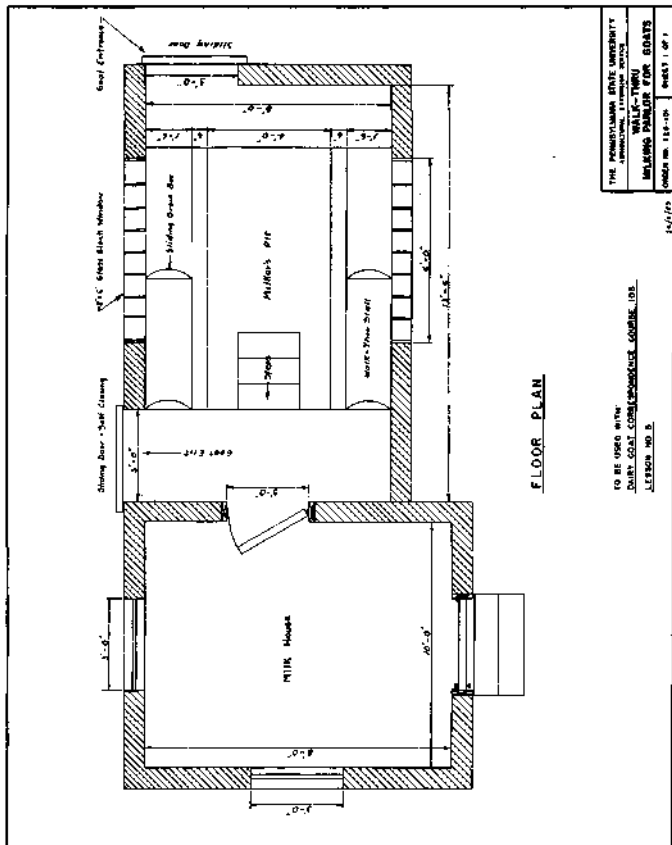
MILKING STAND (OPEN)

NOTE:
 MILK HOUSE AND MILKING ROOM FLOORS TO BE OF SMOOTH CONCRETE.
 WALLS MAY BE OF BLOCK OR FRAME CONSTRUCTION

TO BE USED WITH:
DAIRY GOAT CORRESPONDENCE COURSE 105
LESSON NO. 5

THE PENNSYLVANIA STATE UNIVERSITY AGRICULTURAL EXTENSION SERVICE	
MILK HOUSE, MILKING ROOM, & MILKING STAND FOR GOATS	
ORDER NO. 728-100	SHEET 1 OF 1

26/7/59



Pasteurization of Goat's Milk

Pasteurization is a process which is employed to protect the consumer's health. The fundamental purpose of pasteurization is to insure that milk will be free from disease producing bacteria, with the secondary effect that it prolongs the keeping quality of the product. Raw milk, under some conditions, may contain disease producing bacteria even when handled under ideal conditions. Pasteurization does not compensate, however, for the failure to apply recommended sanitary practices in the production of milk, and should not be regarded as the cure-all for poor sanitary practices in the handling and care of milk.

Fundamentally, pasteurization involves the heating of milk to a specified temperature and holding that temperature for a specified time to insure destruction of disease producing bacteria. The temperatures and times specified are those which have been found, by experimentation to be adequate to cause death of disease producing organisms.

The goat dairy operator has one of two decisions to make regarding pasteurization. First, if he is offering his milk for sale to the consuming public, it will probably be necessary for him to consider commercial scale pasteurization depending upon applicable public health regulations. Since the commercial scale pasteurization is generally quite complex, the goat dairy operator is strongly advised to consult with his local and/or state public health agency to determine the detailed requirements for commercial pasteurization as they would apply to his operations. The goat dairy operator is strongly advised against proceeding into the sale of goat's milk to consumers and/or commercial pasteurization without having consulted with appropriate health authorities since severe penalties may be imposed upon the individual operator who does so.

Secondly, if the milk from the goats is to be used solely in the home for his own family's consumption, then home pasteurization may be followed. A procedure for home pasteurization of milk which is frequently recommended is as follows:

1. Place up to 6 quarts of milk into a glass or stainless steel kettle or flat bottom pan. (Do not use copper, iron, or chipped enamel utensils. Copper or iron utensils may cause an off-flavor in the milk.)
2. Place a floating dairy thermometer in the milk. (Dairy thermometers can be obtained usually in hardware stores or dairy

supply stores. Do not use candy making thermometers since these frequently have metal parts which may impart an off-flavor to the milk.)

3. Heat the milk rapidly, stirring constantly with a stainless steel spoon, until a temperature of 165°F. is reached.
4. Hold at 165°F. for 20 seconds, then place the kettle or pan immediately into a large pan of cold water and with constant stirring, reduce the temperature quickly to 60°F.
5. Store the milk, well covered, in clean containers in the refrigerator at 40°F.

In addition to the process outlined, there are available, electric pasteurizers for home use. These operate automatically and guarantee better temperature control than can be obtained by the method previously outlined. For this reason, they are the preferred system of home pasteurization. Electrically operated home pasteurizers are available through many hardware stores, dairy supply stores and mail order houses. Directions for the use of these are supplied with the equipment.

Keep in mind that home pasteurization is not usually an accepted pasteurization process by public health authorities for sale of milk to the public consumer. Therefore, home pasteurization should not be practiced for this purpose.

Cleaning and Sanitizing Milking Utensils

One of the most important causes for high bacteria counts in goats milk can be the utensils used in the milking and milk handling operations. These utensils must be scrupulously cleaned after each and every milking in order to remove milk residues that bacteria can use as a source of food for multiplying in numbers.

It is essential therefore that anyone involved with the handling and care of goat's milk have an understanding of proper cleaning procedures for milk handling equipment. The following is an outline of a cleaning procedure which has been proven to give very satisfactory results.

1. Rinse - Immediately after milking, rinse all pails, buckets and other utensils with lukewarm water to remove gross milk residues.
2. Add detergent - Fill one side of a double compartment wash sink with water which is hot to the hands and add a good quality alkaline detergent to the water. The amount of detergent to use will depend upon the amount of water in the sink and the rate of usage recommended by the cleaner manufacturer. For example, if there is 10 gallons of water in the sink and the directions for the detergent state "use 1 oz. to each 2 gallons of water", the amount of detergent to use in the 10 gallons of water would be 5 oz. Measure the amount of water and the detergent so you know how much is needed; do not guess. Too little detergent will mean ineffective cleaning, and too much detergent costs you money and does not improve

cleaning effectiveness as some may think!

3. Soak - After the detergent solution has been prepared, place the utensils and equipment in the wash solution and allow it to soak about 5 minutes. This soaking helps to remove soil.
4. Brushwash the Utensils - After soaking thoroughly, brush all surfaces of the equipment to remove all traces of soil using brushes that are properly designed to fit the equipment. Do not clean equipment with steel wool pads as these will scratch the equipment surfaces thereby making focal points for milkstone buildup and subsequent breeding ground for bacteria. During two days of each week, an acid cleaner should be used in place of the alkaline detergent for washing equipment. The acid cleaner is used to prevent mineral deposits from forming on the equipment.
5. Rinse - After each piece of equipment has been brushed, it must be rinsed with hot water. This is most easily accomplished by filling the second compartment of the two compartment sink with hot water and placing the equipment in this water immediately after it has been brushed.
6. Drain - After all utensils have been rinsed, they should be placed on suitable non-rusting drain racks elevated at least 2 feet off the floor and allow them to drain dry. Pails and similar pieces of equipment must be inverted in order for all traces of moisture to drain completely.
7. Sanitize - Just before the next milking, all pieces of equipment to be used must be sanitized to destroy bacteria which may be on the surfaces. This can be done by filling the wash sink with clean water to which is added a chemical sanitizer and placing the equipment in contact with this sanitizing solution for 5 minutes. Listed below are the common chemical sanitizers which can be used and the recommended strength of sanitizer in the water for this operation.

a. Chlorine Compounds	100 to 200 ppm.*
b. Quaternary Ammonium	100 to 200 ppm.
c. Iodophor	15 to 25 ppm.
d. Acid-Wetting Agent Complex	200 ppm.

* ppm. - parts per million

Sanitizers must be used at recommended concentration in order to be effective. Low concentration will yield poor results, and if too high a concentration is used, the sanitizer may inhibit its own action in some cases. Also, the use of a sanitizer will not compensate for a poor cleaning job. In order for sanitizers to be effective, the equipment must first have been properly cleaned.

Goat Equipment Supply Houses - Listing does not indicate endorsement of company or products.

1. American Supply House, Columbia, Missouri
2. HOEGGER Supply Company, Milford, Pennsylvania
3. C. H. Dana, Hyde Park, Vermont (all livestock supplies)
4. See your local supply houses.

Composition and Properties of Goat's Milk

Goat's milk is nearly always pure white in color. The small size of the fat globules and the soft curd are two of its chief characteristics. The cream rises very slowly and never so thoroughly as in cow's milk. This condition makes impracticable, the ordinary method of allowing cream to rise. It has been stated that goat's milk will not keep sweet as long as cow's milk, but tests have shown that this is not the case. The keeping quality of any milk depends on the conditions under which it is produced and handled.

In tests made by the Department of Agriculture it was found that goat's milk could be thoroughly separated in a separator. After milk testing 4.4 percent of fat was run through the separator, the milk then tested only 0.03 percent of fat.

Goat's milk is a healthful and nutritious food. The milk of Saanen and Toggenburg goats resembles that of Holstein cows in percentage of water, lactose, fat, protein, and ash, although subject to greater variation with the advance of lactation than milk of either Holstein or Jersey cows. The percentage of total solids in goat's milk ranged from 13.05 in February to 10.78 in August.

The small fat globules and the soft curd of goat's milk contribute to its ease of digestibility. Some persons who are allergic to cow's milk can consume goat's milk readily, due largely perhaps to its easier digestibility. In a great many cases goat's milk has proved especially valuable for infants and invalids.

Comparison of the Composition of Goat's Milk and that of Two Common Breeds of Dairy Cows¹

Source of Milk	Water	Total Solids	Fat	Protein	Lactose	Ash
Goats ²	88.02%	11.98%	3.50%	3.13%	4.55%	0.80%
Holstein-Friesian	87.50%	12.50%	3.55%	3.42%	4.86%	.68%
Jersey	85.31%	14.69%	5.18%	3.86%	4.94%	.70%

¹From Fundamentals of Dairy Science, by associates of Lore A. Rogers, 1935 edition, Ch. 1, p. 19.

²Average of purebred and high-grade Saanen and Toggenburg does.

Dairy Products from Goat's Milk

Milk which is obtained from properly fed and maintained dairy goats, can be utilized for essentially the same purposes as cow's milk. For general beverage and home use it is very satisfactory, and generally, if a market is available for fluid use purposes, this is by far the most profitable outlet for any production which exceeds actual needs.

Usually, goat's milk is not well suited for butter production due to the fact that the cream rises very slowly to the surface (gravity creaming). Consequently a cream of very low fat content is obtained which does not favor high yield of butter.

It is possible to produce good quality cheese from goat's milk. Two such types of cheese which can be made in the home with a minimum amount of equipment and effort are as follows.

I. Goat's Milk Hard Cheese

Heat sweet, whole goat's milk in a pan to 86°-88°F. Add one percent starter or good quality buttermilk and stir for two to three minutes. Then add rennet at the rate of twenty-five drops to each gallon of milk. The rennet must be diluted in one-half cupful of clean tap water. Stir the rennet into the milk and allow the milk to set at 86°-88°F. until a firm curd forms, usually about thirty minutes. The curd is ready to cut when it breaks clean over a finger inserted into the curd at an angle and lifted slowly.

Cut the curd into squares vertically about one inch on a side with a long blade knife. The curd is then cut into cubes, cutting horizontally with stiff bent wire. When cutting is completed, the curd particles should be uniformly cube-shaped about one inch in size.

Slowly raise the temperature of the curd to about 98°-100°F. within one hour. Stir the curd very slowly at the beginning with a spatula so as not to break up the curd. During the entire heating period, stir the curd frequently enough to maintain an even temperature and to prevent the pieces of curd from sticking together. Cut, with a knife, any pieces of curd that are very large. The curd particles should be kept as uniform in size as possible in order to maintain even heating.

When the curd is firm enough, it has a tendency to stick together. At this time, pour the curd into muslin cloth or bag, and form it into a ball. Allow the ball to hang until all free whey has dripped away - about two to three hours. After draining, remove the cloth from the curd ball, and place the ball on a cheese cloth folded over three or



four times. Fold a long cloth, about the size of a dish towel, into a bandage about three inches wide and wrap it tightly around the ball of curd. Pin the bandage in place. Work the cheese at the top of the ball with your hands until it is perfectly smooth with no cracks extending into the center of the cheese.

Lay a piece of wet cloth over the top of the cheese; place a flat plate over the cloth and weight the plate with a flatiron or a brick. You may find that the weight is likely to fall to one side, causing an uneven cheese. If this is so, make a simple cheese press by sandwiching the cheese between two pieces of clean board. The round wheels of cheese should not be more than six inches across, otherwise there will be a tendency for the cheese to become dry. At night turn the cheese over and replace the weight. Allow the cheese to remain in the press undisturbed until the following morning.

The next day, remove the cloths from the cheese and place in a cool place. Turn twice each day for about three days or until such time as a rind forms. After this time rub a tablespoon of salt each day for two successive days. Following salting, rub the cheeses with a small amount of clear mineral oil for two days, then rub the cheese daily until the rind is very firm. After this, it should be necessary to rub the cheese only about twice a week to prevent drying and restrict mold growth. The cheese should be ready to eat in about eight weeks time.

II. Goats Milk Soft Cheese

Heat one gallon of fresh sweet goats milk to 72°F. To this, add two tablespoons of fresh clean flavored buttermilk and two drops of cheese rennet diluted in one-fourth cup of water. Stir the milk for one to two minutes, then allow it to set at 72°F. for eighteen to twenty hours.

After eighteen to twenty hours setting time, the curd is poured into a muslin bag. The bag is hung up to allow drainage of whey in a cool place. It will require about twelve to twenty-four hours for the whey to drain sufficiently, generally the lower the temperature of the cheese during draining the shorter is the drainage time. When the weight of the cheese has been reduced to slightly less than one half the original weight of milk, drainage is considered to be complete. At this time the cheese is salted to taste. Usually about two teaspoons of salt per pound of cheese is used. The salt is worked into the cheese and the cheese is then held under refrigeration.

This is a fresh milk cheese and should be eaten or used within two weeks after making. Furthermore, it must be kept under refrigeration.

Dairy Goat Products

Dairy goat products are many and varied. Milk is the most common product. In areas of large dairy goat populations the use of goat milk is naturally higher. For instance, per capita goat milk consumption is highest in Southern California where fresh milk sales in 5 countries averaged 68,000 quarts per month, selling at between 50 and 60 cents per quart. In the San Joaquin Valley in California, there are evaporating and drying plants to handle the goat milk production in the area.

Milk goat cheese is another popular goat by-product. Some of the cheeses are as follows: Cottage cheese, Neufchatel cream cheese, F. M. Coulommier, a semi-soft cheese, and various hard cheeses. The kinds of milk cheeses and how to make them are too numerous and detailed to discuss in this publication. Consult your dairy goat associations for further information.

Dairy goat butter is colorless but this can be overcome by using artificial colors. Because the cream doesn't easily rise, it is best to use a cream separator to separate milk from the cream. After separation, it can be made much like any butter.

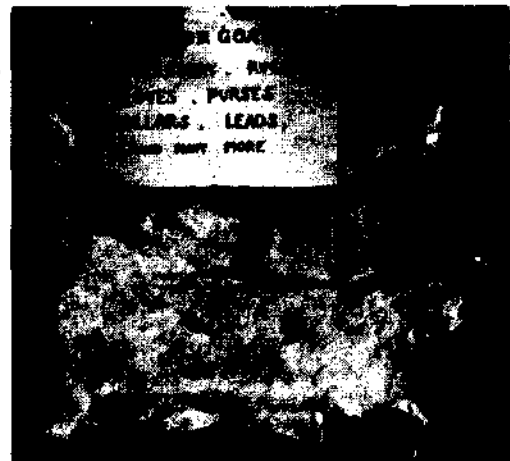
Dairy goat meat - Dairy goat meat is called chevon. In this country, it is seldom seen on the market. In the mountainous, undeveloped countries of the world, it is a standard item of diet. Since dairy goats produce 115 males to 100 females or more, it would seem a waste not to castrate the unwanted males and use them for home meat purposes. Castrated male goats grow proportionately faster than castrates of beef and sheep but the total amount of meat produced is much less. The chief problem with goat meat is a lack of fat. Goat meat ground with pork fat and cooked is delicious. Many good goat meat recipes are available. Refer to Goat Husbandry by David MacKenzie, Publishers, Faber and Faber, Ltd., 24 Russell Square, London, England.

In the United States, certain ethnic groups originating from such southern European countries as Greece and Italy will buy your surplus kids for meat purposes around Easter time.

Dairy Goat Skins - The United States imports about 40 million goat skins annually for shoes, gloves, book bindings, pocketbooks, etc. It would seem that the skins would have commercial value here but apparently the problem is a lack of volume and consistent methods of preparation.

Goat skins can be made into handbags, leather vests, jackets, etc. by those willing to work at it for their own interest. Information on tanning is available at your State University.

Other Suggestions - If you intend to do a large number of skins, the use of an old washing machine would be quite helpful. The buffing might be made easier by using a sanding disk and an electric drill.



Dairy Goat Manure - When properly bedded to soak up urine, dairy goats will produce about 5 pounds of manure daily including the bedding. This would be approximately $1\frac{1}{4}$ lbs. feces and $1\frac{1}{4}$ pounds urine and the rest would be bedding. If the manure is used on gardens, try to keep it as free of weed seeds as possible.

In urban areas where flies and odor are a problem, manure should be stored in cement lined pits with covers to eliminate criticism. The manure may be sun dried, packaged in cellophane bags and sold as a fertilizer for house plants, etc.

THE GOAT SHOW

Goat shows have and will continue to have a favorable influence on the dairy goats themselves and the people preparing and exhibiting the animals whether they be adults or boys and girls. Competition causes people to be concerned with improving their animals as to type and conformation. Competition is good for youth and adults as it helps people to learn how to select top show animals. The hard work of show preparation and the attention to small details usually pays off in ribbons won.



Furthermore, goat shows bring parents and youth together on endeavors they are both interested in, which makes a better understanding.

Fitting and Showing

Dairy Goats - The dairy goat needs special feeding starting 6 weeks or 2 months prior to show day, depending on the condition of the animal. The animal shouldn't be fattened but fed enough extra grain to add bloom to the coat. Additional bedding will be needed to keep the animals clean and avoid stains. Regular leading and posing several weeks prior to the show day will prove very helpful when competing in showmanship contests. Hoof trimming and polishing, clipping, long hair from the backbone and flanks and possibly clipping the animal all over may be required to make it look its best. Brushing and hand work on the hair and skin will improve the quality of hide and hair. Even adding saddle soap to leather show straps will add to the general appearance of a well prepared show animal. After this preparation, it would be decidedly shortsighted to go into the show ring with dirty clothes and hands.

The showman should wear the prescribed white clothes and they should be immaculate for show day. Show authorities should be encouraged to hold fitting and showing contests first and type contests later so children will be more alert and clean than later in the day.

ADGA DAIRY GOAT SHOWMANSHIP SCORE CARD

Based on Usual Order of Consideration		
1. APPEARANCE OF ANIMAL		40
<u>Condition and Thriftiness</u> - showing normal growth--neither too fat nor too thin.	10	
<u>Hair</u> clean and properly groomed.		
<u>Hoofs</u> trimmed and shaped to enable animal to walk and stand naturally.	10	
<u>Nearly disbudded</u> if the animal is not naturally hornless.		
<u>Clipping</u> - entire body if weather has permitted, showing allowance to get a neat coat of hair by show time; neatly trimmed tail and ears.	10	
<u>Cleanliness</u> - as shown by a clean body as free from stains as possible, with special attention to legs, feet, tail area, nose, and ears.	10	
2. APPEARANCE OF EXHIBITOR		10
Clothes and person neat and clean - white costume preferred.	10	
3. SHOWING ANIMAL IN THE RING		50
<u>Leading</u> - enter, leading the animal at a normal walk around the ring in a clockwise direction, walking on the left side, holding the collar with the right hand. Exhibitor should walk as normally and inconspicuously as possible.		
<u>Goat should lead readily</u> and respond quickly.		
<u>Lead equipment</u> should consist of a collar or small link chain, properly fitted.	10	
<u>As the judge studies the animal</u> , the preferred method of leading is to walk alongside on the side away from the judge.		
<u>Lead slowly</u> with animal's head held high enough for impressive style, attractive carriage, and graceful walk.		
<u>Pose and show</u> an animal so it is between the exhibitor and the judge as much as possible.		
Avoid exaggerated positions, such as crossing behind the goat.		
<u>Stand or kneel</u> where both judge and animal may be observed.		
<u>Pose animal</u> with front feet squarely beneath and hind feet slightly spread. Where possible, face animal upgrade with her front feet on a slight incline. Neither crowd other exhibitors nor leave too much space when leading into a side-by-side position.		
<u>When judge changes placing</u> , lead animal forward out of line, down or up to the place directed then back through the line, finally making a U-turn to get into position.	15	
<u>To step animal ahead</u> - use slight pull on collar. If the animal steps badly out of place, return her to position by leading her forward and making a circle back thru your position in the line.		
<u>When judge is observing the animal</u> , if she moves out of position, replace her as quickly and inconspicuously as possible.		
<u>Be natural</u> . Overshowing, undue fussing, and maneuvering are objectionable.		
<u>Show animal to best advantage</u> , recognizing the conformation faults of the animal you are leading and striving to help overcome them.	15	
<u>Poise, alertness, and courteous attitude</u> are all desired in the show ring. Showmen should keep an eye on their animals and be aware of the position of the judge at all times--but should not stare at the judge. Persons or things outside the ring should not distract the attention of the showmen. Respond rapidly to requests from judges or officials, and be courteous and sportsmanlike at all times, respecting the rights of other exhibitors. The best showmen will show the animals at all times--not themselves--and will continue exhibiting well until the entire class has been placed, the judge has given his reasons, and he has dismissed the class.	10	
TOTAL		100

Suggested Uniform:

Long-sleeved white shirt, regulation white pants, 4-H or FFA necktie, 4-H or FFA cap (if applicable), with matching shoes and belt in either black, white, or brown.

ADGA DAIRY GOAT SCORE CARD

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(Ideals of type and breed characteristics must be considered in using this card.)

Based on Order of Observation		30
1. GENERAL APPEARANCE		
Attractive individuality revealing vigor; femininity with a harmonious blending and correlation of parts; impressive style and attractive carriage; graceful walk.		10
<u>Breed characteristics</u>		10
<u>Head</u> - medium in length, clean-cut; broad muzzle with large, open nostrils; lean, strong jaw; full, bright eyes; forehead broad between the eyes; ears medium size, alertly carried (except Nubians).		—
<u>Shoulder blades</u> - set smoothly against the chest wall and withers, forming neat junction with the body.		—
<u>Back</u> - strong and appearing straight with vertebrae well defined.		—
<u>Loin</u> - broad, strong, and nearly level.		—
<u>Rump</u> - long, wide and nearly level.		8
<u>Hips</u> - wide, level with back.		—
<u>Thurls</u> - wide apart.		—
<u>Pin bones</u> - wide apart, lower than hips, well defined.		—
<u>Tail head</u> - slightly above and neatly set between pin bones.		—
<u>Tail</u> - symmetrical with body.		—
<u>Legs</u> - wide apart, squarely set, clean-cut and strong with forelegs straight.		—
<u>Hind legs</u> - nearly perpendicular from hock to pastern. When viewed from behind, legs wide apart and nearly straight. Bone flat and flinty; tendons well defined. Pasterns of medium length, strong and springy. Hocks cleanly moulded.		12
<u>Feet</u> - short and straight, with deep heel and level sole.		—
2. DAIRY CHARACTER		20
Animation, angularity, general openness, and freedom from excess tissue, giving due regard to period of lactation.		—
<u>Neck</u> - long and lean, blending smoothly into shoulders and brisket, clean-cut throat.		—
<u>Withers</u> - well defined and wedge-shaped with the dorsal process of the vertebrae rising slightly above the shoulder blades.		20
<u>Ribs</u> - wide apart; rib bone wide, flat, and long.		—
<u>Flank</u> - deep, arched, and refined.		—
<u>Thighs</u> - incurving to flat from the side; apart when viewed from the rear, providing sufficient room for the udder and its attachments.		—
<u>Skin</u> - fine textured, loose, and pliable. Hair fine.		—
3. BODY CAPACITY		20
Relatively large in proportion to the size of the animal, providing ample digestive capacity, strength, and vigor.		12
<u>Barrel</u> - deep, strongly supported; ribs wide apart and well sprung; depth and width tending to increase toward rear of barrel.		—
<u>Heart girth</u> - large, resulting from long, well-sprung foreribs; wide chest floor between the front legs, and fullness at the point of elbow.		8
4. MAMMARY SYSTEM		30
A capacious, strongly attached, well-carried udder of good quality, indicating heavy production and a long period of usefulness.		—
<u>Udder</u> - <u>Capacity and Shape</u> - long, wide, and capacious; extended well forward; strongly attached.		10
<u>Rear attachment</u> - high and wide. Halves evenly balanced and symmetrical.		5
<u>Fore attachment</u> - carried well forward, tightly attached without pocket, blending smoothly into body.		6
<u>Texture</u> - soft, pliable, and elastic; free of scar tissue; well collapsed after milking.		5
<u>Teats</u> - uniform, of convenient length and size, cylindrical in shape, free from obstructions, well apart, squarely and properly placed, easy to milk.		4
TOTAL		100

ADGA DAIRY GOAT SCORECARD FOR BUCKS

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1.	GENERAL APPEARANCE	40
	Attractive individuality revealing vigor, masculinity with a harmonious blending and correlation of parts; impressive style and majestic carriage; graceful and powerful walk.	
	Breed Characteristics	10
	<u>Head</u> - medium in length, clean-cut; broad muzzle with large, open nostrils; lean, strong jaw; full, bright eyes; forehead broad between the eyes; ears medium size, alertly carried (except Nubian and LaManchas)	5
	<u>Color</u> - appropriate for breed.	
	<u>Shoulder blades</u> - set smoothly against the chest wall and withers, forming neat junction with the body.	
	<u>Back</u> - strong and appearing straight with vertebrae well defined.	
	<u>Loin</u> - broad, strong and nearly level.	
	<u>Rump</u> - long, wide and nearly level.	10
	<u>Hips</u> - wide, level with back.	
	<u>Thurls</u> - wide apart.	
	<u>Pin bones</u> - wide apart, lower than hips, well defined.	
	<u>Tail head</u> - slightly above and neatly set between pin bones.	
	<u>Tail</u> - symmetrical with body.	
	<u>Legs</u> - wide apart, squarely set, clean-cut and strong with forelegs straight.	
	<u>Hind Legs</u> - nearly perpendicular from hock to pastern. When viewed from behind, legs wide apart and nearly straight. Bone strong, flat and flinty; tendons well defined. Pasterns of medium length, strong and springy. Hocks cleanly moulded.	15
	<u>Feet</u> - short and straight, with deep heel and level sole.	
2.	DAIRY CHARACTER	25
	Animation, angularity, general openness, and freedom from excess tissue.	
	<u>Neck</u> - medium length, strong and blending smoothly into shoulders and brisket.	
	<u>Withers</u> - well defined and wedge-shaped with the dorsal process of the vertebrae rising slightly above the shoulder blades.	
	<u>Ribs</u> - wide apart, rib bone wide, flat and long.	
	<u>Flank</u> - deep, arched and refined.	
	<u>Thighs</u> - incurving to flat from the side; apart when viewed from rear.	
	<u>Skin</u> - fine textured, loose and pliable. Hair fine.	
3.	BODY CAPACITY	25
	Relatively large in proportion to size of the animal, providing ample digestive capacity, strength and vigor.	
	<u>Barrel</u> - deep, strongly supported; ribs wide apart and well sprung; depth and width tending to increase toward rear of barrel	13
	<u>Heart Girth</u> - large, resulting from long, well-sprung foreribs; wide chest floor between the front legs, and fullness at the point of elbow	12
4.	MAMMARY AND REPRODUCTION SYSTEM	10
	<u>Mammary</u> - two rudimentary teats of uniform size and showing no evidence of extra orifices, extra teats, spur teats or teats that have been removed. Teats should be squarely placed below a wide arched escutcheon	5
	<u>Reproduction</u> - two testicles of appropriate size for age of animal both showing evidence of being in a viable healthy breeding condition. All visible parts of reproduction system showing no evidence of disease or disability	5

TOTAL 100

HOW TO GROOM AND SHOW YOUR GOATS

Health of Animals - All goat shows should live up to the state health requirements. Animals should be inspected before unloading and if showing signs of illness, they should not be unloaded. Show animals should be isolated from others on returning to the home place, as sometimes disease is picked up from other herds. Watch animals closely for 10 days or so and if there are no signs of illness, pen them as usual. If animals come down with a contagious disease at a fair, get permission to remove them at once.



The Massachusetts Division of Animal Disease Control is located at the Department of Agriculture, 100 Cambridge Street, Boston, Mass. Write to them for specific instructions when going to goat shows. Read your goat show premium list carefully and follow the instructions as to goat health regulations. Goat shows usually require inoculation of animals with an antibiotic just prior to trucking or inoculation for shipping fever 10 days or so prior to taking animals to the show in order for immunity to be established.

DEMONSTRATIONS FOR 4-H MEMBERS AND OTHER YOUTH

AT MEETINGS AND IN CONTESTS

1. Dairy Goat Type Demonstration - good versus poor and why. (use live animals or drawings).
2. Fitting the dairy goat for show - a. feeding, b. grooming c. loading, and d. equipment used, etc.
3. Hoof trimming - why and how - Use a live animal or use charts or both.
4. Internal Parasite Control - why, when, how and what used.
5. High Quality Milk And How to Produce it - clean animals, clipping animals, washing udders, strip cup, how to wash and sanitize equipment, cooling milk, etc.

6. Dairy Goat Products - how to make cheese, list steps, show equipment.
7. Tanning a goat skin - write for information from your State University.
8. Equipment for dairy goat pens - make models and describe use.
9. Demonstrate how to show a dairy goat - use the animal - it could be a good team demonstration.
10. The mammary system of the goat and how it works - use drawings, study a book on the subject and describe.
11. The digestive system of a goat - what we know and what we don't know - use drawings, etc. This requires extra reading and study.
12. Making a good dairy goat fence - drawings, samples of materials, etc.
13. What constitutes excellent hay for dairy goats - kinds (grass or legume), when cut, color, energy values, protein values, mineral values, vitamins, etc., use samples, charts to tell why each protein, energy, mineral, etc. are important.
14. Minerals for Dairy Goats - what they are, where found, their value, amounts needed daily, etc.
15. How to select a dairy goat kid for type and production.
16. What buck I will use and why - records on his dam, records on his sire's side, records on his offspring if available, breed points, type, etc.
17. Ventilation in the goat barn and how it works - insulation, number of goats for area, size of fan if needed, moisture control, etc.
18. Loose housing versus confinement housing - good and poor points of each, cost, etc.
19. How to plan a good yearly goat club program - include demonstrations, contests, recreation, subject matter, how to hold interest, project visits, community service of club, new members records, etc.
20. Determining the age of dairy goats by their teeth - use charts.
21. Add to this list.

DAIRY GOAT ASSOCIATIONS

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For further information on Dairy Goats, contact the American Dairy Goat Association, or your Extension Service, your State University, local Agricultural Schools, National Breed Associations, or local Dairy Goat Clubs.

American Dairy Goat Association, Don Wilson, Sec.-Treas., Box 865
Spindale, North Carolina 28160.

NATIONAL BREED ASSOCIATIONS

The American La Mancha Club. See current issue of Dairy Goat Journal for address of Sec.-Treas.

Alpines International Club. See current issue of Dairy Goat Journal for address of Sec.-Treas.

The National Nubian Club. See current issue of Dairy Goat Journal for address of Sec.-Treas.

National Saanen Club. See current issue of Dairy Goat Journal for address of Sec.-Treas.

National Toggenburg Club. See current issue of Dairy Goat Journal for address of Sec.-Treas.

Massachusetts Council of Milk Goat Breeders Assn., Inc., Mrs. Charles R. Snell, Jr.
Sec., 68 Davis St., Taunton, Mass. 02780 (This is not a National Breed Assn.)

REFERENCE BOOKS ON DAIRY GOATS

Devendra, C. and M. Burns. Goat Production in the Tropics, 1970. Commonwealth Agricultural Bureau, Farnham Royal, Bucks, England.

Klingbiel, A. L. Barns and Buildings. 4th Printing 1970. American Supply House, P.O. Box 1114, Columbia, Mo. 65201.

Leach, Coral A. Aids to Goatkeeping. 6th Edition, 1961. Dairy Goat Journal. P.O. Box 836, Columbia, Mo. 65201.

Leach, E. E. The Goatowners' Scrapbook. 1st Edition, 1961. American Supply House, P.O. Box 1114, Columbia, Mo. 65201.

MacKenzie, David. Goat Husbandry. 2nd Edition, 1967. Faber and Faber, Ltd., 24 Russell Square, London, W.C. 1.

Pegler, H. S. The Book of the Goat. 9th Edition, 1967. American Supply House, P.O. Box 1114, Columbia, Mo. 65201.

Walsh, Helen. Starting Right With Milk Goats, Ed. by Edward Robinson. MacMillan Co., New York.

BULLETINS AND CIRCULARS

New York State College of Agric., Ithaca, N. Y. The Dairy Goat by W. F. Brannon, Cornell Ext. Bulletin 1160.

Pennsylvania State Univ., College of Agric., Ext. Serv., University Park, Penn. 4-H Dairy Goat Project Book.

Rutgers-The State Univ., New Brunswick, N. J., Ext. Serv., College of Agric., Dairy Goat Management, Ext. Bulletin 334.

Univ. of Calif., Ext. Serv., Berkeley, Calif., Your Dairy Goat. 4-H Ag. 26. Prepared by the 4-H Goat Project Development Committee.

United States Dept. of Agriculture. A Dairy Goat for Home Milk Production, Leaflet No. 538.

CORRESPONDENCE COURSE

Dairy Goats. Correspondence Course 105.

Correspondence Courses, 202 Agricultural Education Bldg. Pennsylvania State Univ., University Park, Penn. 16802.

MAGAZINES

Dairy Goat Journal. Published at P.O. Box 1908, Scottsdale, Ariz. 85252.
Kent Leach, Ed.

REFERENCE BOOKLETS

Booklets on the following subject are available through Dairy Goat Journal, P.O. Box 1908, Scottsdale, Ariz. 85252.

Butchering, Chevon, Goat Hides; Butter from Goat Milk; Formulas for Infant Feeding; Goat Products Cook Book; Home Cheese Making.

REFERENCE PAMPHLETS

Pamphlets on the following subjects are available through the American Supply House, P.O. Box 1114, Columbia, Mo. 65201.

Tips on Kid Care; Furs and Skins from Goats; Buying Goats; The Care of Goat Milk in the Home; Goat Milk for Nursing Mothers; Breeding, Pregnancy and Care of Doe at Kidding; Tainted Milk, Its Causes and Remedies; Goat Manure as Fertilizer; Stomach Ulcers; Lets Get It Straight about Brucella Infection; How to Evaluate Your Goats; Kid Rearing with Dry Skim Milk.

REFERENCE BOOKS ON LIVESTOCK, INCLUDING INFORMATION ON DAIRY GOATS

Cole, H. H. ed. Introduction to Livestock Production, Including Dairy and Poultry. 2nd Edition, 1966. W. H. Freeman and Co. p. 827.

Cole, H. H. and P. T. Cupps, ed. Reproduction in Domestic Animals. Academic Press, 1959. p. 657.

Hafez, E. S. E. ed. The Behavior of Domestic Animals. William and Wilkins. 1962. p. 619.

Mauls, J. P. ed. The Semen of Animals and Artificial Insemination. Commonwealth Bureau of Animal Breeding and Genetics. 1962. p. 419.

Menschner, Walter Conrad. Poisonous Plants of the United States. The MacMillan Co., 1951.

Perry, Enos J. ed. The Artificial Insemination of Farm Animals. 3rd Review. Rutgers Univ. Press. 1960. p. 429.

Rice, Victor Arthur, Frederick Newcomb Andrews, Everett James Warwick and James Edward Legates. Breeding and Improvement of Farm Animals. McGraw-Hill and Co., Inc. 5th Edition. 1957.

Siegmund, O. H. ed. The Merck Veterinary Manual, Merck & Co., Inc., Rahway, N. J. 3rd Edition, 1967.

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