



Dairy Goat Production Guide¹

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It is quite certain that the goat was one of the earliest domesticated animals in Western Asia. The goat 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. 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.

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.

In the United States, milk goats are found in every state, with California, Wisconsin, Texas and several eastern states leading in goat population. In recent years, Florida has been rapidly becoming a popular state for dairy goat breeders.

Breeds of Dairy Goats

The American Dairy Goat Association recognizes six breeds of dairy goats in the United States. The five principal breeds are listed in Table 1. They are Alpine, American LaMancha, Nubian, Saanen and Toggenburg. A lesser known dairy breed is the Oberhasli. They range in color from light to deep red with black stripes down the forehead and black legs below the knees. Additional information may be obtained on any particular breed from the various breed organizations, and the American Dairy Goat Association. Also, the Dairy Goat Journal is a monthly publication that provides a lot of good information as well as information on the names and addresses of different breed organizations.

The Alpine, Saanen and Toggenburg breeds originated in the French and Swiss Alps and are often referred to as the "Swiss" type breeds. They are very similar in conformation, all having upright ears, straight or slightly dished faces and an alert, graceful, deer-like appearance.

Alpine

The Alpines are composed of several varieties including the most popular French Alpine and the less numerous British, Rock and Swiss Alpines. They are medium to large in size, with color variations from pure white through shades of fawn, gray, brown, black, red

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buff, and combinations of these colors in the same animal. (See Figure 1.)

Table 1. Average size, milk yield (MY) and composition of dairy goat breeds.*

| Breed | Height (in.) | Weight (lb) | MY (lb) | Fat (%) | Protein (%) |
|---------------|--------------|-------------|---------|---------|-------------|
| Alpine | 30 | 135 | 1990 | 3.56 | 3.06 |
| Am. La Mancha | 28 | 130 | 1712 | 3.80 | 3.29 |
| Nubian | 30 | 135 | 1572 | 4.61 | 3.66 |
| Saanen | 30 | 135 | 2077 | 3.52 | 3.02 |
| Toggenburg | 26 | 120 | 1915 | 3.38 | 3.01 |

* 1989, 305 day DHI breed averages for milk yield and composition.

LaMancha

The LaMancha was developed in the U.S. from crossing a short-eared goat of Spanish origin with purebreds of the Swiss breeds. They are distinguished by very short, or the total lack of, external ears. There are two types of La Mancha ears: the "gopher" ear and the "elf" ear. The allowable length of the elf ear is about two inches and the gopher ear is one inch. There is no preference for ear type in does, but bucks must have the "gopher" ear type to be eligible for registration. The American LaMancha is medium in size with any color or combination of colors and a short, glossy hair coat. (See Figure 2.)

Nubian

The Nubian is a relatively large, proud, and graceful dairy goat of Oriental origin, known for high quality, high milk fat percentage. They are characterized by long drooping ears, convex noses and a short, glossy hair coat. Since any color or pattern is allowed, it is the distinctive convex facial profile between the eyes and the muzzle, and the long bell-shaped ears, that immediately identify the breed. The ears should extend about one-inch beyond the muzzle. They are medium to moderately large in size with good stature. (See Figure 3.)

Saanen

The Saanens are white or light cream in color with white preferred. Spots on the skin are not discriminated against. Small spots of color on the hair are allowable, but not desirable. They are medium to large in size with rugged bone, plenty of vigor yet feminine throughout. The ears should be of medium size and carried erect. A tendency toward a roman nose is discriminated against. (See Figure 4.)

Toggenburg

The Toggenburgs are medium in size, sturdy and vigorous. The Toggenburg may be various shades of brown with white markings. These white markings appear as two stripes on the face from eye area to nose, around the outer edge of the ear, from foot to knee, from foot to hock and as a triangular patch on each side of the tail, covering the pin bone area. Ears are of medium size and alertly carried. (See Figure 5.)

Oberhasli

The Oberhasli dairy goat breed is a newer breed to Florida. The dairy goats are of medium size, vigorous and alert in appearance. The color preferred is chamois but does may be black. The chamois color varies from a light bay to a deep red bay with the latter most desirable. Markings include two black stripes down the face with the forehead nearly all black, black legs below the knees and hocks, and ears black inside and bay outside. The face is straight. (See Figure 6.)

Selecting A Dairy Goat Breed

The greatest number of goat owners in this country keep goats for family purposes. In Florida, there are three licensed commercial dairy goat operations of which two are processing and marketing Grade A pasteurized goat milk and the other is marketing specialty products such as cheese. Most of the operations in Florida are rather small with less than ten milking does. Many of the dairy goats are registered and are exhibited at various shows throughout the state. The more popular breeds are Nubian, Alpine and LaMancha. The Florida Dairy Goat Association and the annual Florida Dairy Goat Production Conference have been helpful in recent years in providing needed materials and information to dairy goat producers.



Figure 1. Alpine

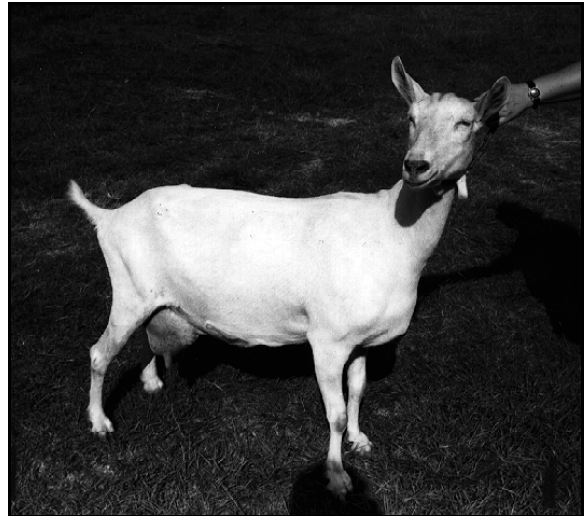


Figure 4. Saanen



Figure 2. LaMancha

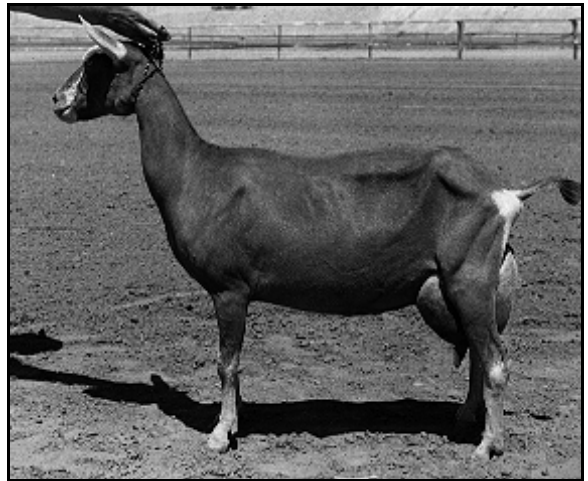


Figure 5. Toggenburg



Figure 3. Nubian



Figure 6. Oberhasli

The selection of milk goats for commercial dairy herds and breeding herds must be accomplished in terms of keeping and maintaining good records, and becoming familiar with the different strengths that dairy goats possess. They may or may not be registered, but must be able to produce milk over a long period of time with good care. Good herds frequently consist of goats having herd averages of 1,500 to 3,000 pounds of milk. The top three dairy goat herds in Florida in 1992 completed DHI 305 day lactation records above 2,100 pounds of milk with the top herd at 2,934 pounds.

For those that are interested in getting involved in raising or showing dairy goats, start with two kids (three to five weeks old) so they can get to know you and you can have the enjoyment of watching them grow. It is best that they be of the same sex, preferably does if you plan to expand. If a buck is preferred, have the breeder castrate and dehorn the animal prior to taking it home. Also at this young age, about a quart of milk is needed daily until about 8 weeks of age. At the time of weaning, the doeling should be eating some grain on a daily basis.

The choice of breed is purely a personal one. We recommend visiting a goat dairy or a dairy goat shows prior to making the final decision on breed. Generally, the breed you start with will end up being your preference.

Breeding and Artificial Insemination

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 matings through good record keeping and a sound breeding program will largely overcome this.

Age to Breed Does

Doelings reach puberty by 6 to 8 months of age and are usually bred at 7 to 10 months of age. At the time of breeding they should weigh about 80-90 pounds (60% of adult weight). If the doelings are not at an optimum weight, breeding should be delayed since puberty is more dependant on body size than age. However, delaying breeding much after 10 months of age decreases the reproductive performance. Growth rates

of replacements should be monitored and their nutrition adjusted accordingly.

For two to three weeks prior to the breeding season does and doelings should be gaining weight. This is achieved by increasing the amount of energy being fed. Does managed in this manner will have an increased number of ovulations.

Signs of Estrus

Estrus is the period when the doe will receive the buck (or the time of Artificial Insemination). Usually this period will last from a few hours to 2-3 days and is characterized by frequent and insistent "talking", tail wagging, and pink color as well as swelling in the external genital region-sometimes with a discharge. A lactating doe will usually drop in her milk production. The period between estrus' is from 17-21 days. To achieve the highest conception rate, it is best to breed the doe on day two of her estrus period.

During the breeding season bucks have a strong odor and should be kept in separate pens at all times. This will aid you in being able to get the does bred over an extended period of time in order that milk will be available over a 12-month period and reduce the possibility of off flavors in the milk.

Maintain good records and record all heat periods. Breed to the best buck available if you plan to retain the kids. Any notes of her behavior may help in out-of-season breeding or in detecting estrus early in the next heat period.

Gestation Period

The gestation period is the time from conception to kidding. Normally this is a period of 145-155 days or on the average 5 months. Does producing milk at the time of breeding will be at their peak production. The doe is usually bred at 45 to 60 days in lactation and will normally be producing milk over a 305 day period. The kidding interval should be about 12 months.

Artificial Insemination

Artificial Insemination (AI) is nothing more than the placement of semen in the female reproductive tract by mechanical means rather than by natural mating. While the term AI does not necessarily imply that the semen used be preserved through prior freezing, this is the most common situation in dairy goats.

The main value of AI lies in its use as a tool for the improvement of livestock, by extending the use of bucks that possess desirable characteristics. There is probably no other sufficient reason (cost, ease, disease control) to consider AI.

Raising Dairy Goat Kids

Kids are born without antibodies circulating in their blood and rely on antibodies in colostrum, or first milk, for protection against disease during the first few weeks of life. The antibodies are concentrated in the doe's udder prior to kidding, are sucked by the kid and then passed through the intestinal wall into the kid's circulation. This transfer, or absorption, is made possible by special cells in the intestinal lining that permit antibodies to pass through for the first 18 hours of life. After that time, the cells are eliminated and no further antibodies can enter the blood stream. It is critical then, that kids suckle soon after birth, preferably within 2-4 hours. Colostrum is also high in nutrient value, especially vitamin A, B-vitamins, proteins, and minerals. The protein content of colostrum is about 20% as compared to 3.5% for normal milk.

Overfeeding colostrum or other milk to kids can cause loose bowels and possibly scours. The extra colostrum should be placed in the refrigerator and fed later at about body temperature. The kid must be handled gently and not forced to drink. After a few hours, the hungry kid will drink readily. The kid may be changed to goat's milk, cow's milk, or powdered milk after about one day on colostrum. Provide about 2 to 3 pints of milk each day in 3 to 4 feedings the first 2 to 3 days and twice per day thereafter.

At birth, the kid weighs approximately 7 to 9 pounds, heart girth 14 to 15 inches, and height at withers 14 to 15 inches. The kid must be treated as a simple stomach animal such as the dog or cat. That is, a milk diet is needed for the first few weeks of life. A small amount of grain such as a calf starter or goat chow may be introduced to the kid at 2 to 3 weeks of age. In general, the grain should contain about 14 to 15% crude protein with added minerals and vitamins.

As soon as the kid starts eating, the rumen starts developing and eventually the kid will start chewing its cud. This is an indication that all four compartments of the stomach (rumen, reticulum, omasum and abomasum) are developing. Animals having four-compartment stomachs are referred to as ruminants. As the animal grows, the rumen becomes the largest compartment.

Clean, fresh water and salt blocks should be available at all times and especially as the kid is weaned from receiving milk at 8 to 12 weeks of age. Start the kids drinking from a bucket as you discontinue milk feeding. Also, be sure the kid has started eating some grain and hay.

All kids should be dehorned at 2 days to 1 week of age, except those that are naturally hornless. Electric dehorners are frequently used with excellent success. Instructions may be received from your County Extension Agent or a local dairyman. The process appears painful but is rather short and causes no harm. An ointment may be applied to the burned area. Dehorning may also be done by a veterinarian under anesthesia. This allows for a more accurate operation with no pain to the kid.

Dairy Goat Feeding and Management Programs

Goats are energetic, inquisitive and versatile in their feeding habits. An area near the barn that provides some browse materials (trees, leaves, bushes, twigs, etc.) appears to be advantageous and enjoyed by dairy goats. The importance of such materials toward the nutritional requirements of lactating dairy goats is probably quite small, especially where a fairly large number of dairy goats are being maintained.

Good quality hay and a balanced grain mix appear to be the best approach in maintaining high levels of milk production. Fiber in the total ration is needed to maintain a normal milk-fat test. However, too much poor quality fiber will lead to lowered levels of milk production. Rations containing some cottonseed hulls or other fibers may be included in the grain where hay or other roughages are not readily available.

The success of a dairy goat enterprise is dependent on the establishment of a good feeding and management program (*see Circular 761 on Feeding and Management of Dairy Goats for further information*). Nonlactating dairy goats do well on good pastures supplemented with minerals. Permanent pastures may consist of several varieties of grasses including bermuda, bahia and pangolagrass and a number of legumes including clovers and perennial peanuts. Summer annual grasses include several varieties of Pearl millet and sorghum-sudangrass. Both are erect, tall-growing, high-producing annuals. Sorghum-sudangrass is adapted to drier soils than millet. Winter annual grasses include rye, oats, wheat, barley

and ryegrass. Excellent grazing may be obtained from winter grasses under conditions suitable for growing them.

Legumes make excellent hay and are usually superior to most other hay crops because of their higher protein content. While alfalfa hay is the best legume hay, variations may occur in quality. Good quality alfalfa hay should have a green color, small stem, adequate in leaves and 17-20% protein. Other legume hays that may be available are alyce clover and perennial peanut.

Grass hay usually varies considerably in quality. Even so, some grass hay may be used in the ration with success. Grass hay as the only roughage source may limit maximum performance. In addition to pasture and/or the forages being fed, the overall ration should be balanced with a good grain concentrate that is fortified with minerals and vitamins. The exact amount needed will vary with pasture and forage quality.

Dairy goats are good eaters and can consume from 4 to 7% dry matter (DM) per 100 lbs body weight as compared to 3-4% DM consumption for dairy cows. This high level of intake allows the dairy goat to have an abundance of nutrients readily available for the synthesis of milk. Overall, the efficiency of milk production by the dairy goat is quite similar to that of the dairy cow.

Important factors to consider when selecting grain rations for dairy goats is quality of forage or roughage being fed as well as the kind of forage. With most grasses and silages in Florida, an 18-20% protein grain mixture is needed to supplement the forage since corn and/or sorghum silage and average quality grass hays are low in digestible protein. With good quality hay (15-20% protein) or the use of small grain pastures such as oat, rye and ryegrass, a 14-16% protein grain mix is generally adequate. The requirements of dairy goats are in Table 2.

Both dairy goats and dairy cows are ruminant animals and can therefore eat the same kind of ration. Common ingredients used are cracked corn, rolled oats, cane molasses, cottonseed hulls, soybean meal, wheat midds and soybean hulls. Assistance may be needed in balancing and formulating the overall ration to prevent problems associated with poor nutrition.

Table 2. Combined requirements and milk production at various levels for dairy goats of two different sizes producing 4% milk fat.

| Milk Yield | Body Wt. (lb) | CP (lb) | TDN (lb) | Ca (g) | P (g) |
|------------|---------------|---------|----------|--------|-------|
| 2.5 | 130 | 0.42 | 3.0 | 9 | 6 |
| | 160 | 0.46 | 3.2 | 10 | 7 |
| 5.0 | 130 | 0.62 | 3.6 | 13 | 9 |
| | 160 | 0.68 | 3.9 | 14 | 10 |
| 10 | 130 | 0.96 | 5.6 | 20 | 14 |
| | 160 | 1.06 | 5.8 | 22 | 16 |
| 15 | 130 | 1.34 | 7.2 | 27 | 19 |
| | 160 | 1.38 | 7.6 | 29 | 20 |
| 20 | 130 | 1.7 | 9.0 | 34 | 24 |
| | 160 | 1.74 | 9.4 | 36 | 26 |

CP = crude protein; TDN = total digestible nutrients; Ca = calcium; 1 lb = 453.6 grams.

Dry Period

The doe should be bred to freshen once each year with a dry period of about two months. The dry period allows the mammary system time to repair and regenerate for the next lactation. The greater her production the more likely that her body has been depleted of the nutrients used in milk secretion and the longer the dry period required to replenish the losses and store adequate reserves for the next lactation. Does which are not given a normal dry period usually produce only 65 to 75% as much milk in the subsequent lactation as does given a dry period.

Grain consumption should be reduced or removed near the time that the dairy goat is turned dry. See Circular 761 for additional information on feeding dairy goats. At the time of drying-off, substitute fair to good quality grass hay for alfalfa or other sources of legume hay. The dairy goat should be down to about three pounds of milk per day or less. Her milk flow will be reduced quicker if you change her routine at the same time you discontinue milking. Since mastitis is frequently started during the dry period, check her udder for possible problems such as mastitis. A certain amount of pressure is needed in the udder in order to stop milk secretion and flow. If the doe has had mastitis

during her lactation, this is the best time to treat it with an appropriate antibiotic for treating dry cows or goats.

The dairy goat should be maintained in good condition during the dry period so she will freshen in a healthy state and have every opportunity to produce more milk in the next lactation. A good mineral mixture should be available. A purchased mineral may contain from 12 to 18% calcium, 6 to 8% phosphorus and 25 to 30% salt, with trace minerals and vitamins. The exact ratio of calcium to phosphorus needed is dependent on forage source since legumes are higher in calcium than grasses.

During the last 3 to 4 weeks of gestation, nutrition becomes more important to the doe. She should receive a better quality grass hay and about the same type of ration she will receive after kidding.

The doe should be managed during the dry period so that she is in good condition at the time of kidding. She should not be allowed to become fat. The key to success is to have the doe kid in a healthy condition and with a fairly good appetite.

Housing

A small barn or shed is needed to reduce the exposure of goats to wind, rain and solar radiation. The type of housing needed will vary with the number of goats owned and the convenience preferred. A stanchion or box stall with built-in feeder may be advantageous for milking.

Does are usually milked on a stand 12 to 18 inches high or higher if preferred. The stand should be long enough for the doe to stand comfortably and about 18 to 20 inches in width. The stanchion should be placed at the front of the stand in order to fasten the doe's head. A small runway may be constructed to the stand to reduce possible udder injury. It is best to construct in an area that can be cleaned easily.

Parasites

Internal Parasites - It is important that your dairy goats live in a good and clean environment (*see Circular 1023 on Common Internal Parasites of Goats in Florida*). A good parasite control program should be initiated as soon as you obtain your first animal. The reason is because parasites begin to grow in numbers and will build-up on closely eaten grassy areas near the barn. Pastures and lots remain contaminated for long

periods and goats may pick up the parasites. Inside the animal, they can interfere with nutrients, cause diarrhea, or result in poor performance of the animal. A good worming program is a necessity for successful dairy goat farming in Florida.

External Parasites - Parasites including lice, ticks, horn flies, house flies, stable flies, horse flies, deer flies and mosquitoes present serious problems during the year. These pests are most prevalent during the spring and summer months. Many are a problem throughout the entire year in Florida.

Lice, both biting and sucking varieties, may present a real problem if not controlled. Since insecticides are frequently changed and taken off the market, contact your local County Extension Agent about current recommendations.

Common Diseases of Dairy Goats

A number of common diseases occur frequently in dairy animals. Most of these diseases are well documented and information is readily available at the University of Florida. While the following information will be brief, it may help you detect possible problems and obtain more detailed information.

Mastitis

Mastitis is simply an inflammation of the udder. It may be rather acute or chronic. Most cases are caused by streptococcus or staphylococcus organisms.

The udder may appear hot, painful, tense, and hard. A wide spectrum antibiotic may be needed or simply penicillin may be effective. The disease can be cured if treated early.

Sanitation during milking is important in the control of mastitis and the making of a clean wholesome dairy product. Many mastitis-causing organisms are present in the environment and can find their way into the udder and milk pail if good sanitation is not maintained. Manure should be removed from the milking areas as frequently as needed.

If milking machines are used, the teat cups should be kept clean and dipped into clean water and then a sanitizing solution between goats. Teat cup liners should be free of cracks, milkstone, and ballooning. Machines should be properly cleaned, sanitized, and

stored after each milking. Clean equipment will reduce chances of mastitis and lower bacteria counts in milk.

Udder Edema

Udder edema and congestion is commonly observed in high producing dairy goats during the late dry period and after parturition. While the problem cannot be totally controlled, limiting the use of sodium (salt) and potassium (good sources are alfalfa hay and cane molasses) as well as high energy feedstuffs such as corn meal in the dry period is helpful. While some corn meal is acceptable, the level fed should be limited to about 20% of the ration. The total ration dry matter should contain about 0.2 to 0.3% sodium and 0.7% potassium. While a lower energy and higher fiber ration is needed for the dry does, lactating does need higher energy feedstuffs in their ration with adequate amounts of good quality forages.

Caseous Lymphadenitis (Abscesses)

This is a common chronic disease of adult goats where abscesses arise from the lymph nodes, particularly about the head, neck and shoulder. This disease may eventually cause emaciation and death of the affected animal due to internal abscesses interfering with vital organs.

The abscesses should be lanced after becoming sufficiently organized near the surface of the skin and the pus carefully collected and disposed of. Four daily shots of penicillin and flushing of the wound with an antiseptic solution until healed should follow. During treatment, the animal should be isolated and the area around the wound washed and dried before returning her to the herd.

Eradication of caseous lymphadenitis from a herd can only be done through a planned program of raising offspring in separate facilities and then disposing of the infected animals. The use of an autogenous bacterin prepared by a laboratory is thought to be helpful in reducing the incidence of disease. No commercial vaccine is presently available.

Contagious Ecthyma (Sore Mouth)

Sore mouth is caused by a resistant virus which produces scabs about the lips and gums. Transmission is through the virus which is contained in the scabby material, which may remain viable in the soil for a long period of time. This disease in kids is more serious as it

prevents normal eating due to the sensitive areas and if nursing, the infection may spread to the teats of the does. Immunity is developed after the initial infection. A vaccination program is valuable in preventing the disease.

Treatment is aimed at preventing a secondary bacterial infection. Gently remove the scabby material with hydrogen peroxide and gauze, then cover the area with zinc oxide or similar ointment. Plastic gloves should be worn as it is transmissible to humans.

Enterotoxemia (Overeating Disease)

Enterotoxemia is caused by a sudden change in feed or overeating by very hungry animals, where the causative bacteria undergoes rapid growth and releases a toxin in the intestines. Regular feeding and vaccinating with *Clostridium perfringens*, type C and type D toxoid will prevent this disease. Adult animals may show depression, intoxication and incoordination whereas in kids, it often just shows up as sudden death.

Foot Rot

Foot Rot can best be prevented by housing your goats in a relatively dry area. The germ which causes foot rot thrives in wet muddy areas where air is poorly circulated.

Symptoms include a grayish cheesy discharge and foul odor with lameness and intense pain. Treat by carefully trimming away the rotten area and treating the infected area with 10 to 30% copper sulfate, a suitable ointment, or other treatment as prescribed by your veterinarian. Proper trimming of the feet will help to reduce infection by the organism.

Ring Worm

Skin infections such as ring worm require treatment. Treatment includes using a solution of glycerine or tincture of iodine. Daily treatment or applications of a mixture of equal parts tincture of iodine and glycerin or a 20% solution of sodium caprylate to the lesion until it disappears often is effective. The antifungal activity of thiabendazole may provide a useful treatment.

Composition of Goat's Milk

The composition of goat's milk varies both within and between breeds. Various values have been reported for each of the nutrients. This has undoubtedly resulted from analyzing milk from a single breed, a single herd, or the analytical techniques used. Goat's milk contains more fat and ash than cow's milk, but has less lactose (Table 3).

Generally, the composition of goat's milk can be expected to fall within a specified range for each milk component. Fat, the most variable component, will usually fall between 3.0 to 6.0% in herd samples. However, values outside this range are not uncommon for individual samples. The ranges that can be expected for total solids, protein, lactose, and ash are 12-16, 3-4, 3.8-4.8 and 0.70-0.95 respectively.

Protein

The protein in goat's milk can be divided into casein and whey protein. Casein accounts for about 83% of the total protein and is the primary protein fraction in cheese products. Casein will coagulate under certain conditions and can be removed from the milk. Rennet, acid, and a combination of pepsin and acid will all coagulate casein in milk. Each method closely resembles a natural process of casein coagulation. Rennet coagulation is the process that is used in cheese making. The addition of acid increases the acidity of milk until the casein coagulates in the same manner as sour milk, and the human digestive process is stimulated by the acid-pepsin coagulation of casein.

Whey is the clear liquid that remains after casein is removed from the milk. Proteins that remain in the whey are the whey proteins.

Both casein and whey proteins are general categories of proteins. Each contain many individual proteins. Many of these proteins are similar to cow proteins and cause identical allergic reactions. However, there are specific proteins in goat's milk and these are immunologically distinct from proteins in cow's milk.

Curd formed in goat's milk with acid-pepsin treatment is apparently softer than the similarly formed curd of cow's milk. However, curd formed with rennet appears to be stronger in goat's milk than in cow's milk. Curd strength varies between individual animals and lactation. Curd strength decreases to minimum in mid-lactation and then increases to the end of lactation.

Although the average percentage of fat in goat's milk is 4.25% (Table 1) it varies with individual animals, breeds, state of lactation, and type of feed. Goat's milk fat contains appreciable amounts of caproic, caprylic, and capric fatty acids. Although these fatty acids are not unique to the goat, they are more abundant in goat's milk than milk from other species. They are responsible for the characteristic flavor and odor of cheeses made from goat's milk.

Goat's milk contains a higher proportion of small fat globules than cow's milk but is similar to sheep's milk in this respect. This has been interpreted as the reason for the slow creaming of goat's milk. However, the primary reason for slow creaming is the absence of fat globule clustering. Cow's milk contains a protein, not found in goat's milk, that causes fat globules to cluster, thus creaming at a rapid rate.

Table 3. Average composition of milks from various mammals.*

| Species | Water | Fat | Protein (%) | Lactose (%) | Ash (%) | Nonfat Solids | Total Solids |
|---------|-------|------|-------------|-------------|---------|---------------|--------------|
| Goat | 87.00 | 4.25 | 3.52 | 4.27 | 0.86 | 8.75 | 13.00 |
| Cow | 87.20 | 3.70 | 3.50 | 4.90 | 0.70 | 9.10 | 12.80 |
| Ewe | 80.71 | 7.90 | 5.23 | 4.81 | 0.90 | 11.39 | 19.29 |
| Human | 87.43 | 3.75 | 1.63 | 6.98 | 0.21 | 8.82 | 12.57 |

* Data from *Fundamentals of Dairy Chemistry*, page 6. Ed.: Webb, B.H. and A.H. Johnson, 1965. AUI Publishing Co., Inc., Westport, Conn.

Vitamins

Considerable information has been compiled concerning the vitamins in the milk of various species. The primary difference between goat's milk and cow's milk is the much lower concentration of vitamins B₆ and B₁₂ in goat's milk. However, when considering the use of goat's milk for infant food it bears consideration that goat's milk is nearly as high in vitamin B₆ and twice as high in vitamin B₁₂ as human milk. Cow's milk is extremely low in vitamin D and none is listed in the table. However, most commercial milk is fortified with vitamin D.

It is very interesting to note that vitamin A in goat's milk exists exclusively as vitamin A and not carotenoid pigments. Carotenoid pigments are precursors of vitamin A and are present at varying levels in cow's milk depending upon the breed. Carotenoid pigments cause fat to have various degrees of yellow coloring. Their absence in goat's milk causes butter made from goat's cream to be white.

Production of High Quality Milk

All hair should be clipped closely on the udder and flank area for cleanliness and health reasons. Also, milk taken from such animals is easier to keep clean.

Herds should be checked for brucellosis and tuberculosis to insure that these potential human pathogens are not present. If these diseases are discovered the animals should be removed from the herd.

Milking Procedures

The milking procedures should follow recommended sanitation practices whether it is hand or machine milking.

The udder and particularly the teats should be washed with warm water (110 degrees F) that contains an appropriate sanitizer. This not only stimulates the animal for milking, but also has the potential of destroying organisms on the teat that might contaminate the milk. The first few strips of milk from each teat should be examined for abnormalities with a strip plate. Milking, whether by machine or hand, should begin within 2-3 minutes of washing the udder. If milking is done by hand, special precautions should be taken to prevent contamination of the milk. A

hooded pail is an asset for hand milking. After milking it is desirable to dip each teat in a dairy teat dip. Teat dips have proven quite successful in the prevention and reduction of mastitis.

Milk should be filtered through commercial filters and cooled immediately. If commercial milk cooling equipment is available, the milk should be cooled to 35 degrees F as quickly as possible. However, if this is not available, milk will cool much more rapidly if it is placed in circulating cold water than if it is immediately placed in a refrigerator.

Care of Milking Equipment

The production of high quality milk requires strict cleaning and sanitizing procedures for all equipment that comes in contact with milk. Cleaning and sanitization can be done manually or mechanically depending on the type of equipment used on the farm.

The basic steps in cleaning and sanitization are as follows:

- 1) Immediately after milking, or removal of milk from equipment, rinse the equipment with lukewarm water before the milk dries on the surface.
- 2) Prepare a detergent solution according to manufacturers' specifications making sure the water temperature meets or exceeds the minimum recommended temperature. If manual cleaning is employed, brush all milk contact surfaces thoroughly. All milk contact surfaces that are not cleaned by mechanical cleaning or circulation cleaning must be brushed.
- 3) Rinse detergent from tank with tap water. Preferably, an acidified rinse should be used to prevent the accumulation of milkstone.
- 4) Drain rinse water from all equipment
- 5) Immediately before using the equipment sanitize with an approved dairy sanitizer. Either chlorine or iodine can be used at concentrations of 200 and 25 ppm respectively.

Dairy Goat and Goat Organizations

American Dairy Goat Association, Box 865,
Spindale, NC. 28160.

American Goat Society, 1606 Colorado St.,
Manhattan, Kansas 66502.

Alpines International, Secretary-Treasurer Bonnie
Kempe, 409 Sampan Ave., Jamestown, RI 02835.

American LaMancha Club, Secretary-Treasurer
Gerri Horka, P.O. Box 1832, Sebastopol, CA
95473.

International Nubian Breeders Association,
Secretary-Treasurer Shirley Gardner, P.O. Box
130, Creswell, OR 97426.

Oberhasli Breeders of America, Secretary-
Treasurer Mimi Waterman, 33 Kerr Rd.,
Canterbury, CT 06331.

National Saanen Breeders Association, Secretary-
Treasurer Sandy Oelschegel, 189 Burbank Rd.,
Sutton, MA 01527.

National Toggenburg Club, Secretary-Treasurer
Sharon Lederer, 1680 East 3400 So., Wendell, ID
83355.

National Pygmy Goat Association, Secretary
Suzanne Chapman, 4310 Mistleoe Rd., Manmouth,
OR 97361.

Publications, Circulars, Fact Sheets and Supply Sources

American Dairy Goat Association, Box 865,
Spindale, NC 28160. Dairy Goats-Breeding,
Feeding, and Management, Leaflet No. 439 (1966),
and Own A Dairy Goat.

Caprine Supply, P.O. Box Y, 33001 West 83rd St.,
DeSoto, KS 66018.

Dairy Goat Journal, W2997 Market Rd.,
Helenville, WI 53137.

Jeffers Supply, Box 100, Dothan, Alabama 36302.

MacKenzie, Davis, *Goat Husbandry*, 5th Edition,
1975, Diamond Farm Book Publishers, Dept. DG,
Box 266, Alexandria Bay, NY 13607.

NASCO, 901 Janesville Ave., Fort Atkinson, WI
53538.

Common Internal Parasites of Goats in Florida,
Circular 1023, University of Florida, Dairy and
Poultry Sciences Dept., Gainesville, FL 32611.

Feeding and Management of Dairy Goats, Circular
761, University of Florida, Dairy and Poultry
Science Dept., Gainesville, FL 32611.

4-H Dairy Goat Judging, Circular 4-H 321,
University of Florida, Dairy and Poultry Sciences
Dept., Gainesville, FL 32611.

Fitting and Showing 4-H Dairy Goats, Circular 4-
H 299, University of Florida, Dairy and Poultry
Sciences Dept., Gainesville, FL 32611.