

ALL ABOUT GOATS

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Distribution

The goat is one of the smallest domesticated ruminants which has served mankind earlier and longer than cattle and sheep. It is managed for the production of milk, meat and wool, particularly in arid, semitropical or mountainous countries. In temperate zones, goats are kept often as supplementary animals by small holders, while commercially cows or buffaloes are kept for milk, cheese and meat, and sheep for wool and meat production. Nonetheless, there are more than 460 million goats worldwide presently producing more than 4.5 million tons of milk and 1.2 million tons of meat besides mohair, cashmere, leather and dung; and more people consume milk and milk products from goats worldwide than from any other animal. Cheese production, e.g., from goat milk even in France, Greece, Norway and Italy is of economic importance. Goat herds, on the other hand low producing though, are an expression of capital assets and wealth in Africa and Asia where they are found in large numbers. In the United States, there are between 2 and 4 million head; with Texas leading in Angora, meat and bush goats; and California leading in dairy goats.

Goats can survive on bushes, trees, desert scrub and aromatic herbs when sheep and cattle would starve to death. Goat herders often have neglected a rational numerical balance between goat numbers and sparse vegetation. Over-grazing has destroyed many tree and woodland areas which was blamed then on goats rather than man, and this has caused widespread ecological and political concerns, erosion, desertification and even ban on freely grazing goats in some areas. On the other hand, goats are valued by cattle and sheepmen in the fight against brush encroachment on millions of acres of open rangeland.

Swiss goat breeds are the world's leaders in milk production. Indian and Nubian derived goat breeds are dual-purpose meat and milk producers. Spanish and South African goats are best known for meat producing ability. The Turkish Angora, Asian Cashmere and the Russian Don goats are kept for mohair and cashmere wool production. In addition, there are Pygmy goats from Western Africa of increasing interest as laboratory and pet animals.

Goat milk casein and goat milk fat are more easily digested than from cow milk. Goat milk is valued for the elderly, sick, babies, children with cow milk allergies, patients with ulcers, and even preferred for raising orphan foals or puppies. Fat globules in goat milk are smaller than in cow milk and remain dispersed longer. Goat milk is higher in vitamin A, niacin, choline and inositol than cow milk, but it is lower in vitamin B₆, B₁₂, C and carotenoids. The shorter chain fatty acids (C₆, C₈, C₁₀, C₁₂) are characteristically higher in goat milk than in cow milk. Otherwise milk gross composition from goats or cows is similar except for differences due to breeds, climate, stage of lactation and feeds.

Breeds of goats vary from as little as 20 lb mature female bodyweight and 18 inches female withers for dwarf goats for meat production up to 250 lb and 42 inches withers height for Indian Jamnapari, Swiss Saanen, Alpine and Anglo-Nubian for milk production. Some Jamnapari males may be as tall as 50 inches at withers. Angora goats weigh between 70 to 110 lb for mature females and are approximately 25 inches tall. Birthweights of female singles are between 3 and 9 lb; twins being often a pound lighter and males ½ lb heavier. Twinning is normal in goats with a high percentage of triplets thus giving several breeds an average annual litter size above 2 per doe and more than 200% reproduction rate. Females are called doe, young are kids, males are bucks; one speaks of buck and doe kids, and doelings, and of wethers or castrates.

that of bulls and may be stored for years in 1 ml ampules or ½ ml straws in liquid nitrogen tanks for artificial insemination use.

Origin

Wild goats or escaped feral goats are found in many countries and islands and can be harmful to the vegetation if numbers are left uncontrolled.

Truly wild goats are found on Creta, other Greek islands, in Turkey, Iran, Turkmenia, Pakistan; in the Alps, Siberia, Sudan, Caucasus; the Pyrenees, the Himalayan, Central Asian, Russian and Tibetan mountain ranges, and prefer rocky, precipitous mountains and cliffs. Goats can not be herded as well with dogs as sheep; instead they tend to disperse or face strangers and dogs head-on. Relatives of true goats are the Rocky Mountain goat, the chamois of the Alps and Carpathian, and the muskox.

Goats belong, scientifically, to the Bovidae family within the suborder of ruminants (chevrotain, deer, elk, caribou, moose, giraffe, okapi, antelope), who besides the other suborders of camels, swine and hippopotamuses make up the order of even-toed hoofed animals called artiodactyla. They have evolved 20 million years ago in the Miocene Age, much later than horses, donkeys, zebras, tapirs, rhinoceroses, who make up the order of uneven-toed hoofed animals; and the hyrax, elephants, manatees who make up the ancient near-hoofed animals. All these are herbivorous mammals, i.e., they live from plants and nurse their young with milk from an external gland after the young is born, having been carried in pregnancy to term relatively long in an internal uterus with a complex, nourishing placenta.

Goats and sheep make up a tribe within the Bovidae family called Caprini that include six goat, six sheep and five related species. Goats have a 2n chromosome set number of 60 while domestic sheep have a 2n set of 54; yet living hybrids of the two genera have been reported. The six species of goats can be distinguished by their horn shapes:

1. *Capra aegagrus*, the wild (or bezoar) goat of Near East Asia has scimitar-shaped horns with a sharp anterior keel and a few knobs interrupting it.
2. *Capra ibex*, the ibex of the Alps, Siberia and Nubia has scimitar shaped horns with a flatter front and many transverse ridges.
3. *Capra falconeri*, the markhor of Central Asia has sharpkeeled horns that are twisted into open or tight spirals.
4. *Capra pyrenaica*, the Spanish goat has outward-upward curving horns with a sharp posterior keel.

5. *Capra cylindricornis*, the Dagestan tur of the Caucasus mountains has round outward-back inward curving horns.
6. *Capra hircus*, the domestic goat evolved principally from *capra aegagrus*, except for Angora, Cashmere goats, and Damascus types who descended from *capra falconeri*.

Breeds

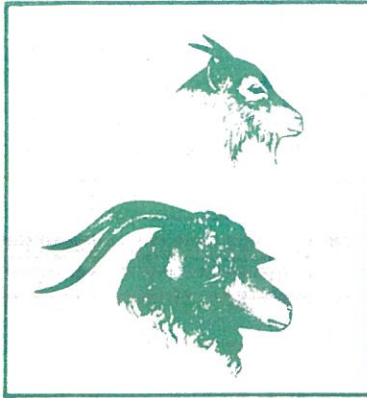
Domestic goat breeds are many. Swiss breeds are distinguished in milk producing ability and have influenced significantly milk production from goats around the world, especially in Europe, North America, Australia and New Zealand. A few breeds kept mostly for meat are the South African boer goat, the Indian beetal, black Bengal, the Latin American criollo, the US "Spanish" goats and most of the small or nondescript goats. Fiber producing goat breeds are the Angora in Turkey, USA, South Africa; the Cashmere in Afghanistan, Iran, Australia and China; and Don breed in Russia.

The major breeds of US goats are:

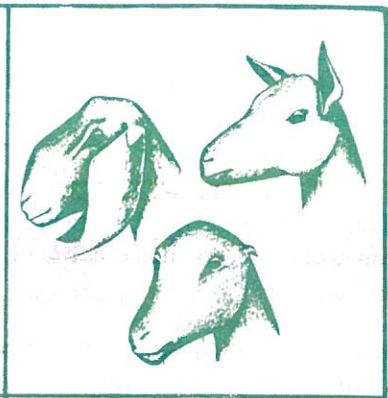
Saanen originate from Switzerland (Saanen Valley), are totally white, with or without horns. The white color is dominant over other colors. They are mostly short haired. The "Appenzell" is a similar breed, but partially related to the Toggenburg is from Northern Switzerland, longhaired, white and hornless. Saanen have been exported around the world as leading milk producers. An Australian Saanen doe holds the world record milk production of 7,714 lbs in 365 days. Saanen have been bred in Switzerland for odorfree milk long ago.

Toggenburg, brown with white facial, ear and leg stripes, another straight nosed, horned or hornless, mostly shorthaired, erect eared goat, as all Swiss are, has been very popular in the USA, comes from N.E. Switzerland, but is 4 inches shorter in height and 18 lb lighter in average than the Saanen. They have been bred pure for over 300 years, longer than many of our other domestic breeds of livestock. They are reliable milk producers summer and winter, in temperate and tropical zones. Mrs. Carl Sandburg, wife of the famous US poet had several world record Toggenburg does on official USDA tests.

Alpine (including French, Rock and British), another Swiss breed (French Switzerland), horned or hornless, shorthaired, as tall and strong as the Saanen, with usually faded shades of white into black, with white facial stripes on black. They are second in milk production to Saanen and Toggenburg.



Extension Goat Handbook



FEEDING

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Goats are good browsers and can selectively utilize a wide variety of shrubs, woody plants, weeds, and briars. If you allow the goats to roam the woods, be sure that there is no wild cherry, hemlock, azaleas, or species of laurel family nearby because these plants are poisonous. While such grazing simplifies management, it can result in bad eating habits.

Does enjoy browsing, but they cannot produce much milk without hay or pasture plus grain. Yearlings, dry does, and even low producers, however, may get enough nutrients from browsing to satisfy their minimal needs.

Feed Choices

Pasture – Often the lowest cost feed available is pasture. It does not have to be harvested, stored, and fed out if grazing is permitted. You can economize by relying heavily on pasture during the summer months. The best pasture for goats consists of alfalfa-bromegrass or a mixture of clover and timothy. Pastures will yield their most when they are limed, fertilized and clipped on a routine basis. Small herd owners very likely will not have the equipment to develop good pastures. When limited pastures are available, they are often overstocked and overgrazed, which kill off the pasture and encourage the growth of weeds. When circumstances do not permit extensive pasture management, an effort should be made to rotate animals to other pasture lots if they are available. If not, pasture feeding should be appropriately supplemented with other feeds such as greenchop, root crops, or wet brewery grains.

Pasture has some limitations. Bloat is a constant

concern with pastures heavy in alfalfa, particularly in early spring and fall. The quality of pasture changes with each passing day. The energy level drops between 0.5 and 0.75 megacalories per hundred pounds of dry matter per day. The water content of lush pasture is so high that it cannot support high levels of milk production.

Because of these fluctuations in nutrient content, it is always good management to provide grazing goats free access to hay while they are on pasture. It will offer some protection against bloat and provide a source of feed to compensate for the decline of nutrients in the pasture.

Management tips for goats on pastures:

1. Provide easy access to shade and water.
2. Have available salt and a mineral mix or offer a mix of equal parts trace mineral salt and dicalcium phosphate.
3. Rotate animals among pastures where possible. This permits pastures to rejuvenate and also tends to break the cycle of internal parasites.
4. Provide ready access to hay.
5. During early spring pastures, be alert to possible cases of bloat and grass tetany.

Dry Forages – Aside from brush lands and pasture, another low-cost feed for goats is good quality legume hay, such as alfalfa or clover, even when heavily mixed with bromegrass, orchard-grass, or timothy. Legumes are favored over grasses because they are much higher in protein and in a variety of minerals.

The nutrient composition of forages can be determined by analysis in a forage-testing laboratory. Your county agricultural agent can help you select a laboratory. A visual examination can yield considerable information about hay quality such as:

1. Earlier cutting date indicates more digestible nutrients.
2. More leaves provide more protein and minerals.
3. Lack of seed heads indicates early cutting.
4. Coarse stems suggest late cutting while

ed. It contains higher levels of total protein, milk solids, globulins, fat, and vitamin A than normal milk. It is also laxative. Most important, colostrum contains antibodies against diseases to which the doe has immunity. Young kids are able to absorb this antibody protection effectively at birth, but by the time they are three days old, this ability will almost disappear. The newborn kid should receive fresh warm colostrum before it is 15 minutes old, if possible, to give maximum protection. During the first two days of life, kids should receive at least three colostrum feedings per day. A kid will consume about 1-½ to 2 pints daily.

As soon as the kids are strong and can drink milk easily, they can be fed from a pan or pail. Cow's milk may be substituted for goat's milk after the kid is a few days old. This sometimes reduces the cost. Make the change gradually over a period of several days. Excellent growth and health can be achieved by feeding kids one of the high-quality milk replacers currently available. Because of varying formulations, care should be taken to follow the manufacturer's directions. The milk or milk replacers should be heated to about 100 °F. Twice-a-day feeding of milk is adequate and no more than 3 pounds should be fed.

Weaning – As young kids approach weaning age - three to four months - gradually add warm water to their milk diet. This will provide them with the necessary fluids for rumen development and ease the stress of weaning them. After the kids are weaned from the milk, feed them all the bright green forage they will eat, plus ¾ to 1 pound of any good dairy calf-starter ration.

Feeding grain and forage – Young kids will not consume much solid food at first, but small amounts of a starter feed can be placed in front of them during the first week. A mixture of equal parts of cracked corn, crushed oats, wheat bran, and about 10 percent soybean meal can be used. Early consumption can be encouraged by putting some of the grain in the milk. Hay can also be offered at this time, but it should be the finest hay available. Early forage consumption will lead to early rumen development and will thus permit early weaning.

To develop prime herd replacements with a chance for good milk production, good eating habits must be established. Browse feeding is not necessary. Such feed is often very fibrous, woody, and low in energy. Train a goat to eat a "domesticated" ration of hay, pasture, and grain from the early days of life. If treated to woods and weeds from birth, kids will not break such habits easily.

Yearlings

In feeding young animals, the object is to provide enough nourishment for body maintenance and

growth. Too much feed causes animals to fatten which could lead to difficulties in breeding. After 4 to 6 months of age animals should have good pasture - if available, high-quality hay and a place to exercise. A ½ pound of grain per day should lead to ample growth. If the forage is poor, animals may require 1 to 1-½ pounds of grain daily. Yearlings can be fed the same grain mix that is fed to the milking herd. Low-quality forages should be supplemented with a 12 to 14 percent protein grain mixture. Free access to water, if located away from the manager, will encourage exercise. A mixture of equal parts of trace mineralized salt and dicalcium phosphate is suitable for free-choice feeding.

Dry Does

Dairy goats should be given a 4-to 6 week dry period prior to kidding. The unborn kid develops 70 percent of its weight during these last 6 weeks of pregnancy. It is important that a balanced diet be fed. Unborn kids grow rapidly and need protein, calcium, and phosphorus for muscle and bone development. A steady diet of scant pasture and poor hay could produce weak or dead kids, or ones that die shortly after birth.

The dry period is a good time to rejuvenate the ruminant system. Good pasture will maintain a doe at this time, with only mineral supplementation needed (salt and dicalcium phosphate should be available). In the absence of pasture, a mixture of good alfalfa and grass hay can be used. Alfalfa contains too much calcium in relation to phosphorus to be used as the sole forage for pregnant does. If the doe is under weight, ½ to 1-½ pounds of grain might be fed daily. The grain should contain 12 percent protein if alfalfa hay is fed or 16 percent protein if grass is the major forage. Does should be kept in good flesh but not fat.

A few days before freshening, cut the grain feeding in half and replace it with wheat bran. This is a good source of protein and phosphorus. The laxative effect of the bran will help clean out the digestive tract.

Milking Does

The nutritional demands upon the lactating does are tremendous. It is essentially impossible for the doe to consume enough to meet the demands for body maintenance and milk production during the first few months of lactation. She must draw upon her body reserves to balance the nutrients consumed.

To meet the needs of the lactating doe as closely as possible, it is necessary to feed the best quality legume hay or green forage available. The quantity of hay may have to be limited to 3 pounds to en-

Table 1. Protein Content

Cutting Date	Non-Legumes % Protein	Legumes % Protein
June 1	13.5	18.7
June 15	10.0	14.5
July 1	6.7	10.2
July 15	3.7	6.4

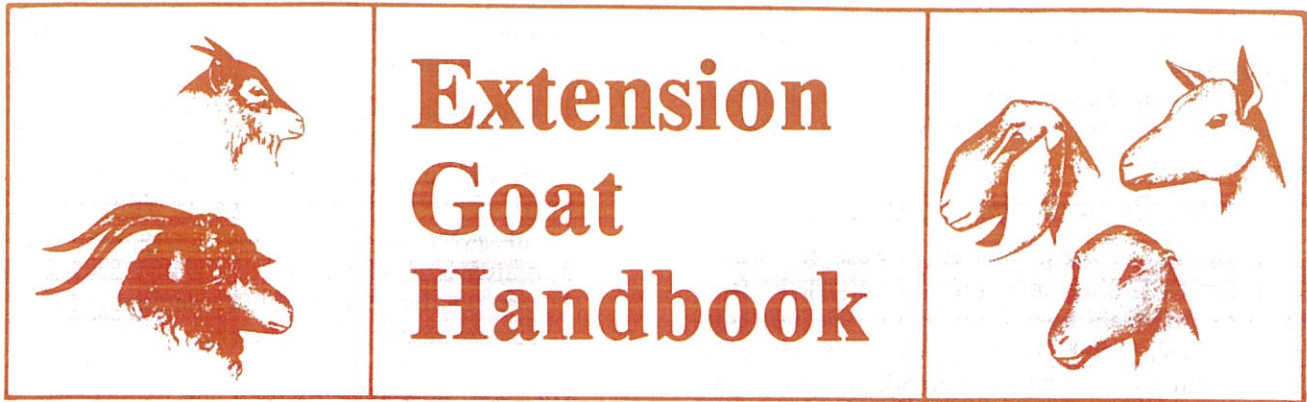
Table 2. Suggested Dairy Goat Rations

Ration 1		
Alfalfa or Clover Hay		2 lbs daily
Corn Silage		1½ lbs daily
Grain (16-18% Protein)		1-2 lbs daily*
Ration 2		
Alfalfa or Clover Hay		3 lbs daily
Grain (12-14% Protein)		1-2 lbs daily*

*Depending on level of milk production.

Table 3. Sample Grain Mixtures for Lactating Goats

Ingredients	1	2	3	4
	Level of Protein in Finished Mix			
	14%	16%	18%	20%
	Pounds			
Rolled Corn	900	800	720	656
Crimped Oats	421	300	240	200
Beet-Citrus Pulp	200	200	200	200
Dried Brewers Grain	—	150	200	200
40% Protein Supplement	300	—	516	—
Soybean Meal	—	356	—	600
Molasses	150	150	100	100
Trace Mineralized Salt	10	20	10	20
Dicalcium Phosphate	—	10	10	20
Monosodium Phosphate	15	10	—	—
Magnesium Oxide	4	4	4	4



HOUSING

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Dairy goats do not need fancy housing. Many older buildings can be adapted to cut costs. Those intending to remodel a building for housing goats or build a new one should first visit several goat dairies, inquire about the strengths and weaknesses of their housing systems, then contact the local county agent regarding insulation and ventilation needs.

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 milking does and loose housing for the yearlings and kids.

Loose Housing

This has many advantages and some disadvantages. These may be summarized as follows:

Advantages:

1. Exercise resulting from the freedom is desirable.
2. Daily handling of manure is minimal or possibly eliminated.
3. Manure pack, when kept dry, provides heat and comfort.
4. Building construction and maintenance costs are minimized.

Disadvantages:

1. Boss goats, especially when horned, may cause injury.
2. There will be much riding when a doe is in heat.
3. More bedding is required.
4. A separate milking parlor is an absolute requirement.

Dirt pen floors are preferred over cement. At least 15 sq ft of bedded area should be provided for each goat. The floor should be bedded regularly with dry straw, wood shavings or ground corn cobs to absorb moisture. Some dairymen construct feeding stanchions at the feed bunk. Stanchions permit one to control intake of feed grains. At least 10 ft of vertical space from floor to ceiling rafters is desirable to facilitate cleaning with a tractor and front-end loader.

Goats prefer to be outside some on nice days, even when it is cold. The outside exercise lot should provide a minimum of 25 sq ft of space per animal, be well-drained and properly fenced. Goats like to lean on the fence to greet visitors. A 6-inch woven wire fence (4 to 5 ft high) is adequate. Some goats will get out of nearly any fence. In this case, place an overhanging wire from 10 to 12 inches from the inside and top of the fence, supported by offset pieces nailed to the posts. This wire may be electric, although barbed wire is usually adequate. Put snap hooks on all gates. Goats are able to unlatch other types of hardware.

Confinement Housing

This also has several advantages and disadvantages, namely:

Advantages:

1. Less bedding is used.
2. Individual pens permit more attention to the needs of each animal.
3. It is easier to show animals to prospective buyers.
4. An outside exercise lot is not an absolute requirement.

Disadvantages:

1. Building costs are increased because of concrete floors, and individual pens.
2. Individual pens are more labor intensive.
3. Poorly ventilated housing is conducive to more health problems.

Table 1. Thermal Resistance Values of Commonly used Materials. Values do not include Surface Resistances.

Material	Thermal Resistance (R)	
	Per Inch Thickness	For Thickness as Manuf.
Batt or Blanket Insulation		
Glass wool, mineral wool, or fiberglass	3.0-3.7	
3-3½ in batt		11
5 1/5-6 ½ in batt		19
Fill Type Insulation		
Glass or mineral wool	2.2-3.6	
Vermiculite (expanded)	2.20	
Shavings or sawdust	2.20	
Cellulose products (milled pulverized paper or wood pulp)	3.70	
Rigid Insulation		
Insulating board		
Sheathing, regular density 1/2 in		1.25
Sheathing, regular density 25/32 in		2.06
Expanded polystyrene extruded, plain	4.00	
Expanded polystyrene, moulded beads	3.57	
Expanded polyurethane (aged)	6.25	
Glass Fiber	4.00	
Ordinary Building Materials		
Face Brick	0.11	
Concrete poured	0.08	
Concrete block, 8 in		1.04
Concrete block, 8 in with cores filled		1.93
Lightweight concrete blocks, 8 in		2.18
Lightweight concrete blocks, 8 in with cores filled		5.03
Plywood	1.25	
Plywood, 3/8 in		0.47
Plywood, 1/2 in		0.63
Hardboard, medium density	1.37	
Plasterboard, 3/8 in		0.32
Plasterboard, 1/2 in		0.45
Cement asbestos board	0.25	
Lumber (fir, pine, and similar soft woods)	1.25	
Asphalt shingles		0.44
Wood shingles		0.94

Fresh Air

An inlet system must be provided for satisfactory ventilation. This is frequently overlooked or ignored, especially when attempting to use older buildings, and is the most common cause of unsatisfactory ventilation performance.

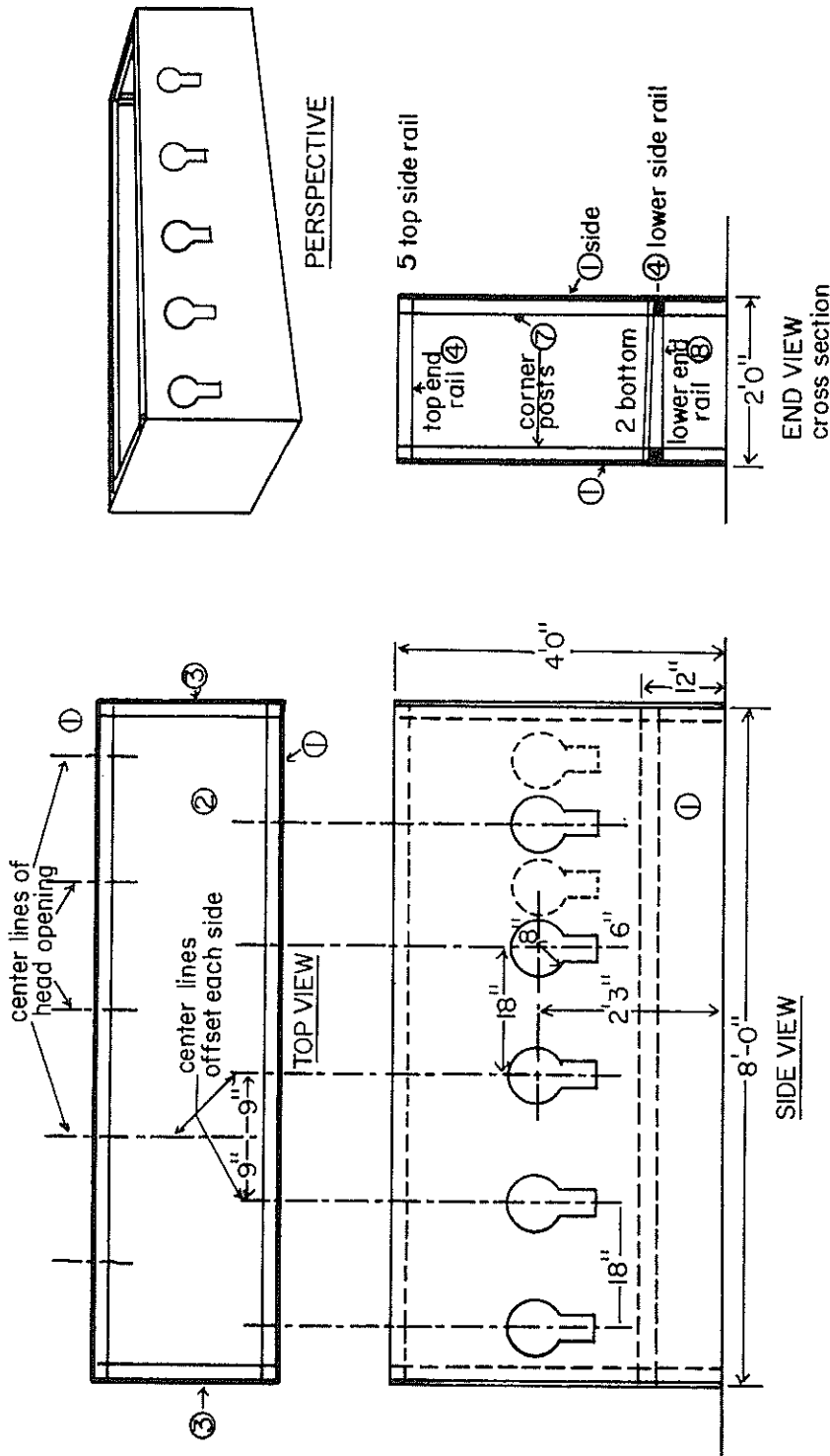
A slot inlet system permits adequate distribution of small amounts of air in many places. It can easily be built into the barn during construction by making an adjustable slot at the junction of the walls and ceiling, except for a distance of 4 ft on either side of each exhaust fan. Air is drawn into

the barn through these inlets by the exhaust fans.

This slot should be 1 inch wide for winter use.

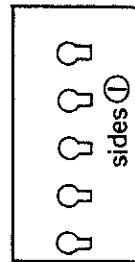
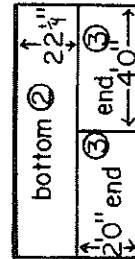
Note: if all fans are placed along one side of our 36 ft long "example" barn, then a 1-inch slot along the other side will provide 3 sq ft of air inlet. Air velocity entering the building will be 133 ft per minute (400 cfm ÷ 3 sq ft) or 1.5 miles per hour, enough to prevent a back draft (excess of 100 ft per minute is recommended), but not enough to be considered an excessive draft.

During the fall and spring months, when one of the thermostatically controlled fans will be



LIST OF MATERIALS 8' UNIT, 10 GOATS

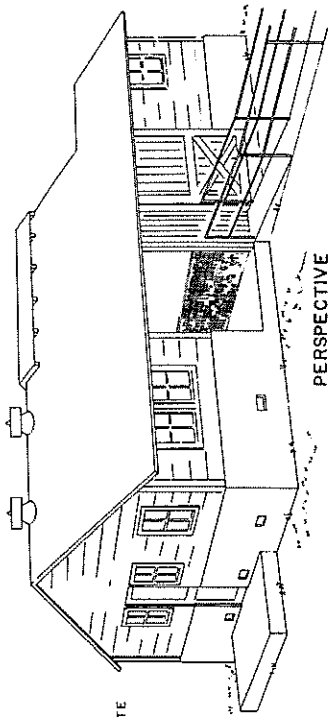
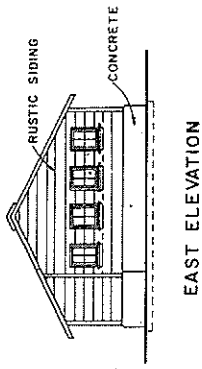
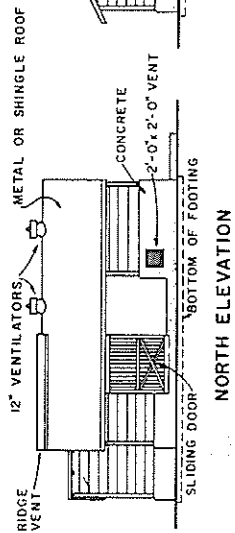
- ① ② ③ 5/8" exterior plywood
 - ④ ⑧ end rails 4 pieces 2x2x24"
 - ⑤ ⑥ side rails 4 pieces 2x2x8
 - ⑦ corner posts 4 pieces 2x2x3
- USE GALVANIZED NAILS



CUTTING DIAGRAM FOR PLYWOOD

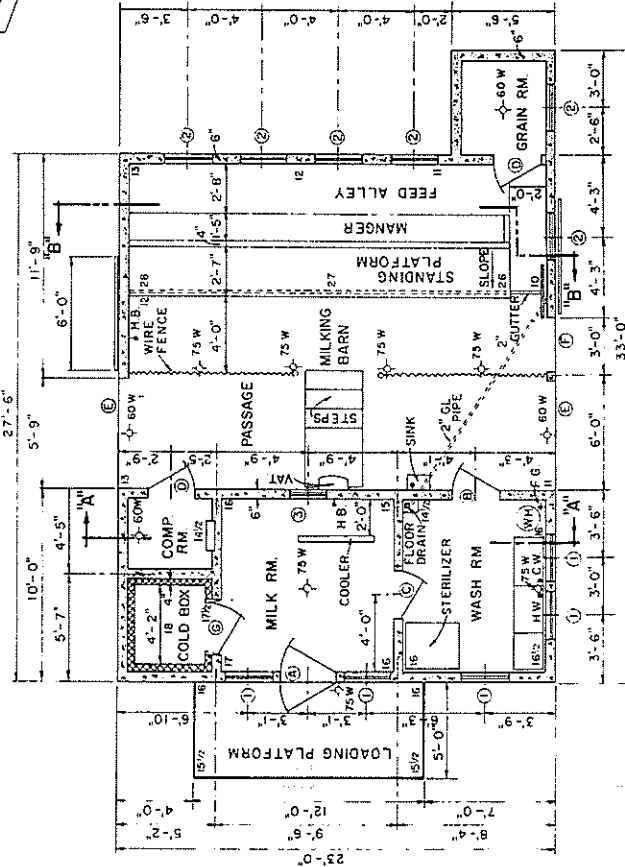
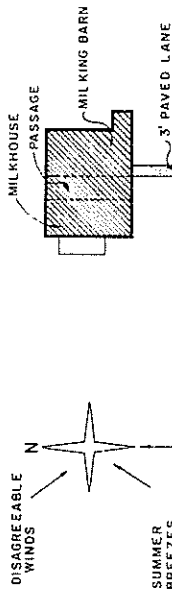
USE 5/8" exterior plywood

Keyhole goat feeder plan. Drawing courtesy of Pennsylvania State University Cooperative Extension Service.



PERSPECTIVE

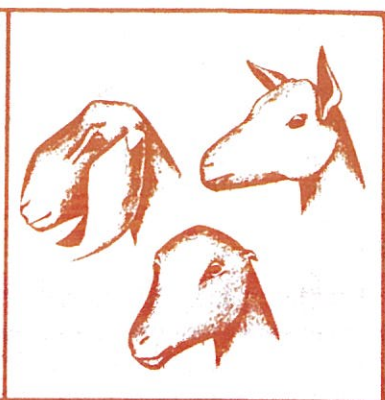
MILKHOUSE MUST BE AT LEAST 100 FEET FROM FEEDING BARN OR RACKS



Tie stall barn plan for 30 milking goats. Drawing courtesy of Pennsylvania State University Cooperative Extension Service.



Extension Goat Handbook



MANAGEMENT – BIRTH TO BREEDING

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Kid management from birth to breeding is an essential component of the dairy goat enterprise. With the possible exception of the nutritional management of the doe herd, the kid management program has the greatest effect on the long-term productivity of the dairy goat herd. The dairy goat kid at birth represents a genetic resource necessary to replenish the herd gene pool which has a changing composition due to death, culling and sales for breeding stock. While the genetic character of the kid is determined at the time of conception, survival to lactation and an adequate body size are necessary to realize inherent genetic potential for lactation. One of the advantages of the dairy goat is the opportunity for rapid genetic progress due to early sexual maturity (breeding is possible at 7 months or less), short gestation interval (150 days) and multiple offspring per parturition (2.0 or more for mature does). Kid mortality has a direct effect on genetic progress by its effect on selection pressure, that is, the percentage of the kids which must be retained as replacements. Maintaining low mortality from birth to weaning while producing a 100 lb doe at kidding should be the primary objective of the kid management program.

As practiced on most dairy goat farms, the kid raising enterprise is highly labor-intensive. Because in the absence of control programs involving lighting and/or hormonal treatments, dairy goats have a highly seasonal reproductive cycle, a

labor-year profile for kid raising would show a peak demand in January through May, with low demand in July through November. In order to reduce the characteristic high labor input per unit of milk produced on dairy goat farms, attention should be given to systems of kid management which reduce labor while keeping mortality low.

Pre-Parturition

The kid management program should actually begin prior to parturition with attention to the nutritional needs of the gestating doe in late lactation and during the dry period. With a gestation period of 150 days, most of the development of the dairy goat fetus occurs when the nutritional demands on the doe are at their lowest; late lactation and during the dry period. The tendency is to regard the late-lactation and dry doe as a non-productive part of the milk-producing system. On the contrary, however, an adequate diet for the dry doe is essential to producing a healthy litter of kids. Depending upon the forage source and size of the doe during the dry period from one to two lb of a 10 to 16 percent concentrate ration should be fed daily. Pregnant does should receive plenty of exercise. An overly fat doe should be avoided but the high producing doe needs to recover body weight lost during the previous lactation. Clean, cool water and free choice trace-mineralized salt should be available. A supplement of bone meal will aid in fetal development but care should be taken to not overfeed calcium.

Vaccination boosters for *Clostridium perfringens* C and D and tetanus toxoid should be given not less than 3 weeks prior to kidding. Vitamin E/selenium injections are given during the dry period to prevent white muscle disease in the kids, especially in areas where soils are selenium deficient. Does should be wormed at drying off.

Fact Sheet	Date	Page
B-3	1984	1

In raising dairy goat kids, increase in size and weight are not the only measurements of success. A well formed skeleton and proper development of internal organs are often neglected when the emphasis is on rapid gains. An average daily gain of 250 gm during the first weeks of life should be the goal. By limiting daily milk consumption to about 2 quarts, daily consumption of dry feed will be encouraged. Dry feed consumption is important in developing body capacity. By increasing body capacity, feed intake and digestion increase. Research has shown that at two months of age a weaned kid has a reticulo-ruminal capacity 5 times as large as suckling kids of the same age.

Kids should be consuming forages such as pasture grass or hay by two weeks of age and grain within four. Careful attention need be given to formulation of a concentrate supplement for the pre-weaning kid. Palatability is of primary concern. Molasses at the rate of 10% of the total dry matter, corn (preferably chopped or rolled) and whole or rolled oats make up the energy "core" of a good preweaning diet. Balance the crude protein needs by adding cottonseed or soybean meal or another high protein source. Though few studies with kids have been done, crude protein contents of the pre-weaning ration should be within the range of 14-18%. Ground alfalfa may be added at 5% or less to provide additional stimulation for reticulo-ruminal development.

Several factors need to be considered when making the decision as to when to wean dairy goat kids. The most important consideration is whether or not the average daily consumption of concentrate and forage is adequate for growth and development to continue in the absence of milk. Fixed weaning ages are less desirable than weight goals such as 2.0 to 2.5 times birth weight. Many producers who have an erratic or marginal market for their milk delay weaning for longer periods than necessary. While milk feeding may promote more rapid growth than a concentrate-forage diet, maintaining kids on milk may delay the attainment of the dry feed intake level necessary to weaning and also leaves the kid disposed to diarrhea.

Kids should be dehorned between 3 and 14 days of age, while the horn bud is visible. The hair should be clipped and a hot electric disbudder held over the area for 15 to 20 seconds with firm even pressure. The center of the ring formed by the iron should also be burned and the cap remaining pried off. A topical spray should be applied to avoid problems with flies on the resulting wound. A local anesthesia such as lidocaine may be used to decrease pain and permit easier handling of the kid. Restraint devices are available to purchase or may be homemade.

At about 3 to 4 weeks of age kids should receive a vaccination for *C. perfringens* CD and also tetanus or any bacterin for which there is a problem in the herd. A booster should be given in two weeks.

Buck kids to be slaughtered under 2 months of age need not be castrated. If meat goats are to be kept until an older age, castrating can be done at 2 to 4 weeks. The lower part of the scrotal sac is cut with a knife and the testicles squeezed through the openings. The cords are then cut by scraping with a sterilized knife or scapel. Iodine or topical spray is applied. The "bloodless" method of castration using a Burdizzo clamp can be equally effective if care is taken to crush both cords. Use of elastic bands is not to be recommended due to potential development of gangrene.

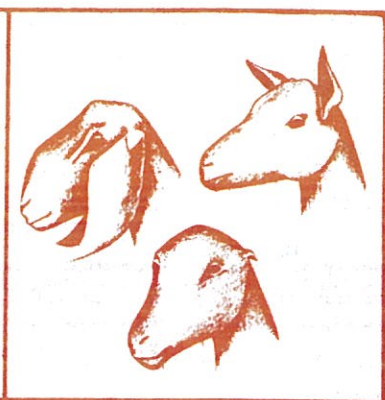
Weaning to Breeding

The objective of raising the dairy goat kid should be to produce a lactating animal with an adequate body size as inexpensively as possible and in the shortest possible time. For the heavier breeds (Saanens, Alpines, Nubians), the goal should be a 110 lb doe freshening at 12 months of age and 90 lb for the lighter breeds (LaMancha, Toggenburg). If a doe is weaned at 8 weeks, weighing 20 lbs and is to kid at 12 months, at 110 lbs, then she must gain 90 lbs in 10 months, or approximately $\frac{1}{3}$ lb daily. Therefore, the nutritional program must aim for a growth rate of approximately 150 gm daily with consideration for both the nutritional requirements of the growing doe and the growing fetus over the 5-month gestation period.

Forage must constitute the core of an economical diet for growing dairy goat kids with mixed concentrates or simple grains fed to provide the nutrients that are not provided by the forage consumed. Forage quality is therefore very important but because the dairy goat is a browsing animal, it is quite poorly estimated. Leaves and young stems chosen by browsing animals have crude protein and digestible energy values higher than the average for the whole plant. The kid grazing on improved pasture, browsing in woodlots or consuming alfalfa hay is able to select plant parts which have a higher nutritional value than laboratory analyses of the forage samples might show. Given the ability of the dairy goat to selectively browse, in order to formulate a program of supplementation on a forage-based diet, one must estimate what the kid is actually consuming rather than what is available. If good quality, leafy alfalfa hay is fed in quantities which allow for selection, a simple supplement of 2 lb of corn or oats per head, daily gain is adequate. On lower quality forage such as poor quality grass hay, or grazing where intake of dry matter might be limited by water



Extension Goat Handbook



MANAGEMENT TECHNIQUES

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Dehorning (disbudding)

For humane reasons, goats to be dehorned should be anesthetized, although some people use dehorning restraint boxes for kids. A local block is sufficient, or general anesthesia such as xylazine is suitable. If local anesthesia is used, the infratrochlear nerve (at the dorsal medial margin of the bony orbit) needs to be blocked as well as the cornual nerve (at the caudal ridge of the root of the zygomatic process). Only about ½-1 cc of local anesthetic is injected at each of these sites. The anesthetic (lidocaine) should be diluted to 0.5% to avoid toxicity.

Xylazine at a dose of 0.1-0.2 mg/kg bodyweight given intramuscularly or intravenously is sufficient to cause short term (15-30 minutes) general anesthesia. This has proven to be very satisfactory for short surgical procedures, such as dehorning, but weights of goats must be determined accurately and overdosing avoided.

Ideally, goats should be dehorned when they are very young. It is advisable to wait until they are 1-2 weeks of age and in good flesh to be sure they are healthy and not coming down with neonatal diarrhea. If discolored skin is fixed to the skull in 2 rosettes, horn buds are present. Moveable skin indicates a naturally hornless condition. At this young age, the goat can be surgically or electrically disbudded. In either case, about 1 cm of tissue should be removed around the horn to prevent regrowth and horn scurs. If an electric dehorner is the choice, it should be used very hot (to the point of being red hot) and then be applied to each horn

bud for only about 10 seconds. Long term application may lead to thermal meningitis. Whether using surgical removal or this thermal cautery, the horn bud should be removed completely.

In older goats the surgery is much more extensive and requires opening the frontal sinus. It is a slow healing process and should not be done during fly season unless absolutely necessary. In older animals, general anesthesia (such as xylazine) or a combination of tranquilization and local nerve blocks is essential for restraint. Using a scalpel to make a skin incision around the horn and at least 1 cm from its base, obstetrical cutting wire is then used to remove the horn. With an assisting person straddling the goat's head, the wire sawing is started behind the horn and worked straight forward. Bleeding blood vessels are pulled or cauterized. The procedure is repeated on the other horn. Barnes mechanical dehorners (scoops) should not be used in goats since they tend to scoop too deeply and can lead to a dangerous exposure of the goat's brain. Elastrator rubber bands can be used successfully, as an alternative unbloody procedure, but unless properly placed, regrowth and scurs are a problem. In either case, prophylactic tetanus shots are strongly recommended.

Deodorizing (descenting)

The major scent glands of male goats are located posterior and medial to the base of the horn. These areas are quite easily identified if the top of the head is clipped or shaved. The glands have less hair than the surrounding head and appear almost glossy in nature. They are easily removed during dehorning by making the incision around the base of the horn a little wide (1-1.5 cm) at the posterior medial corner of the horn. It has been reported that bucks with a high odor level are more stimulating to female goats. However, goat odor is very offen-

Fact Sheet	Date	Page
B-6	1984	1

pelvis in goats is usually large enough to permit manipulation of the fetus and correction of the problem. A cesarean section may be indicated, however, and several approaches can be used at the discretion of the operator. However, performance of this and other surgical procedures should be attempted only by licensed veterinarians.

The right flank offers little or no advantage over the left flank. The left flank approach is advantageous, since it is easier for a single surgeon to hold the rumen in, than to keep the intestines in place. Consequently, the left flank is probably preferable over the right. Flank incisions for cesarean sections offer the advantage of requiring little or no tranquilizer or general anesthesia (both of which will depress the fetus). If the surgeon feels tranquilization is necessary, 1-2 mg of xylazine (total dose) should be sufficient. This often permits restraint of the animal in lateral recumbency. Flank incisions also avoid the abdominal veins associated with the udder and greatly diminish the likelihood of an evisceration or post-surgical hernia.

The ventral incision (midline or paramedian) is probably preferred with:

1. fractious animals who may not stand for the entire surgery,
2. toxic animals who are too weak to stand,
3. dead mascerating fetus.

Toxic animals may be tied and restrained in dorsal recumbency. However, fractious animals will require either a general anesthetic or a large dose of tranquilizer such as xylazine (0.1 mg/kg bodyweight). In either case, a large area should be clipped and surgically prepped. In standing surgery, the goat often moves around and drapes tend to be more of a detriment than an asset. Doing surgery without drapes requires a large, surgically clean area. If the animal is restrained in lateral or dorsal recumbency, the animal can be draped. Ten to 12 ml of xylocaine can be used to infiltrate the proposed surgical incision site or to do an inverted L-block in the flank. One must remember that the abdominal wall in an advanced pregnancy in a goat is very thin and care should be taken not to infiltrate more than the thickness of the wall. A 6-8 inch incision will probably be needed for adequate uterine exposure.

After routine entry into the abdomen, one should locate the ovarian end of a pregnant uterine horn and gently bring it to, and if possible, through the incision. In doing this, it is often helpful to grasp a limb through the uterine wall and use this as a handle to help elevate the uterus. In case of a live, uncontaminated fetus, the uterus can be opened within the abdomen if necessary. However, if the fluids are contaminated, the portion of the uterus to be opened must be exteriorized. An incision parallel to the long axis of the uterus and along the

greater curvature (3-5 inches long) will avoid most of the uterine blood supply. Grasping the feet, or the head and feet, the kid is delivered through the incision. Passing the hand back into the uterine incision, the uterus is checked for more kids. If present, they are delivered in a similar manner. Rarely is more than one incision into the uterus needed.

After the last kid is delivered, the uterine wall should be closed with an inverting suture (Cushing, Lembert or Guard's Rumen Stitch) using a #1 chromic gut. In the case of contaminated uterine contents, a second inverting suture should be used to oversee the first suture line. Either as the uterus is being closed or after surgery, through the vagina, some type of uterine medication needs to be used. Any type of antibacterial preparation is probably acceptable for this, although 1 ounce of soluble tetracycline powder seems to work best; it medicates the uterus, is absorbed, and will provide a good systemic blood level.

Body closure can be accomplished in 2 or 3 layers depending on whether one prefers to close the peritoneum as a separate layer. In a flank incision, simple continuous sutures of #1 or #2 chromic gut work well. In ventral approaches, one would be advised to use interrupted sutures. In either case, nonabsorbable skin sutures should be used, which have to be removed in 10 to 14 days.

Pregnancy Examination

Several methods are available, besides radiography and ultrasound. Milk and serum progesterone levels at 21 days after breeding are non-pregnancy tests; the absence or low level of progesterone is proof that the doe is not pregnant. At 3 months, the pregnant doe begins to "pot out", especially with twins. External palpation from the body floor just ahead of the udder can confirm a fetus, when giving the relaxed goat cold water to drink and feeling the kick of the fetus; twins might be too cramped to kick noticeably.

At 3-½ to 4 months pregnancy, ballottement from the right flank can confirm the presence of a fetus.

Near parturition, the ligaments left and right of the tailhead on the sacrum are very much relaxed and sunken-in. The udder is full, tight, and milk is present. Some udders do not fill until after kidding.

Quiet does, pregnant 70 to 100 days, can be palpated rectally with a plastic rod about 50 cm (20 in) long and 1.5 cm (0.6 in) in diameter. The doe is placed on her back and the well-lubricated rod inserted about 35 cm (14 in) (inclusion of a soapy enema helps). The anterior end of the rod is moved toward the abdominal wall cranial to the pubic bone. The pregnant uterus can be felt through the abdominal wall as the rod forces it upward. The

Weighing

Keeping good weight records is important for proper feeding and medication, besides good management. Tapes can be used for estimation of weight by measuring the heart girth behind the forelegs:

Lb Body Weight	Inches Heart Girth
20	17- $\frac{1}{2}$
30	20
40	22- $\frac{1}{2}$
50	24
60	25- $\frac{1}{4}$
70	27- $\frac{1}{2}$
80	29
90	30- $\frac{3}{4}$
100	32- $\frac{1}{4}$
125	34- $\frac{3}{4}$
150	37- $\frac{1}{4}$
175	39- $\frac{3}{4}$
200	42- $\frac{1}{4}$

There also exists normal growth curve to age-weight relationships. For large breed male goats, they are in average as follows:

1 month - 25 lb
2 months - 40 lb
3 months - 55 lb
4 months - 65 lb
5 months - 75 lb
6 months - 85 lb
8 months - 100 lb
9 months - 110 lb
10 months - 115 lb
11 months - 120 lb
12 months - 130 lb
18 months - 155 lb
24 months - 170 lb
30 months - 180 lb
36 months - 205 lb

For smaller breeds and females, these standards are less, proportionate to the lesser adult bodyweight. There are positive correlations between higher body weights in growing kids and later lactation milk yields.

Reviewed by S. B. Guss, Pennsylvania State U., University Park.



Dehorning with a hot electric iron. Photo courtesy of F. A. Wright, Rutgers University, New Jersey.