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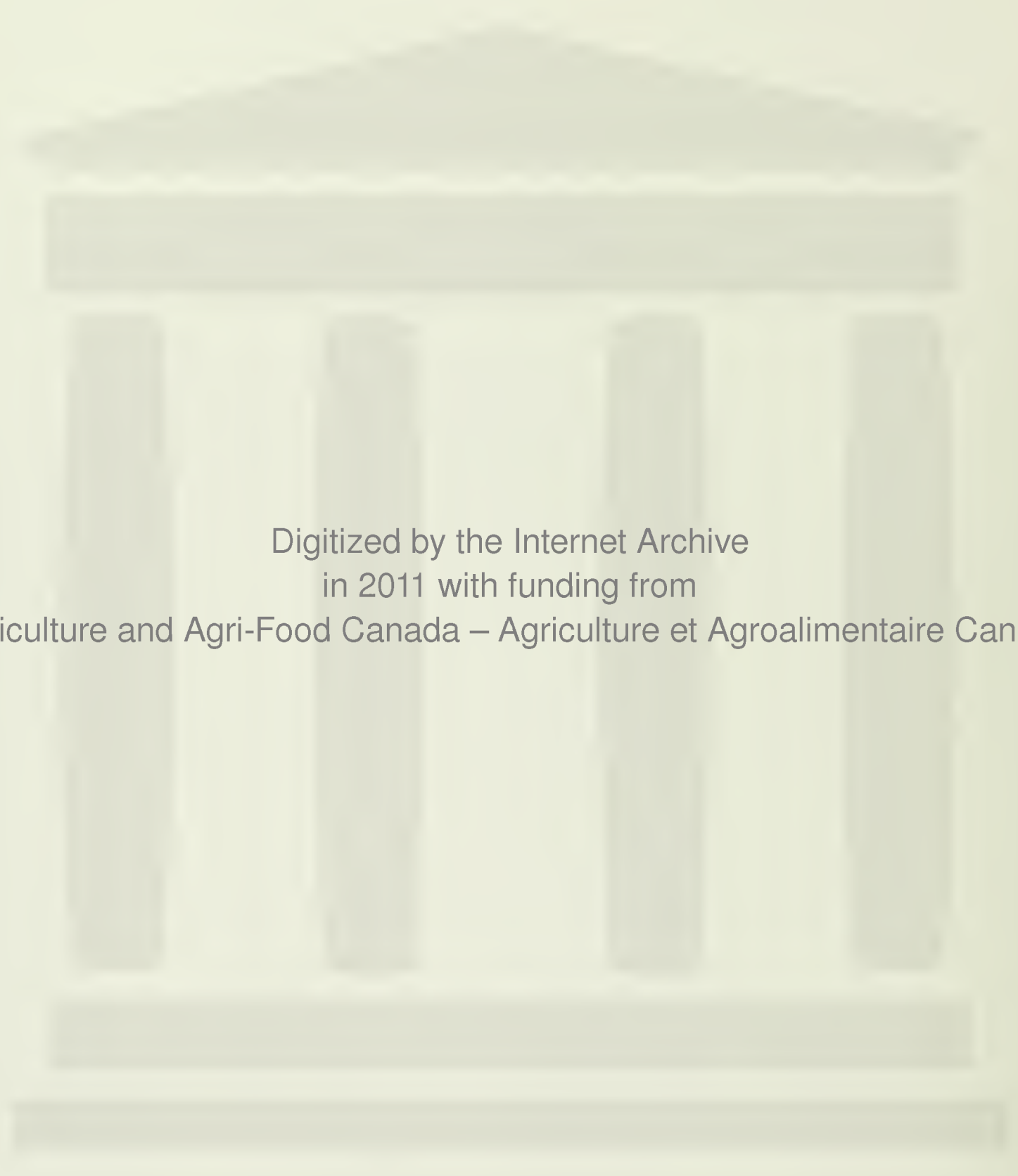
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GOATS and their management

Canada



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GOATS AND THEIR MANAGEMENT

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FOREWORD

This publication will benefit anyone seeking information on goats and their management. It was prepared by the Canadian Goat Society for publication by Agriculture Canada.

Canada's goat population consists largely of the dairy breeds, so this publication is devoted to their needs. However, the final section describes Angora, Dwarf and Pygmy goats; for more information, contact the Canadian Goat Society.

Written and illustrated by Sara Emond, goat technician under contract to Alberta Agriculture.

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INTRODUCTION

Goats are inquisitive, mischievous creatures, but undeniably strike a chord deep inside the human heart.

Goats are highly social. Although they seem to gang up on new arrivals into the herd, they do accept the need to live together. They can also accept people as part of the herd, and often willingly follow their human 'head goat'. Kids in particular are very trusting in their first few hours, and a doe whose kidding has been attended by a human is altogether happy to accept that person as one of her 'kids'. Perhaps these qualities made the goat's domestication possible.

People domesticated goats as early as 10 000 years ago – far earlier than any other animal, including the dog. Undoubtedly, they kept this early goat mainly for fresh meat.

From this primitive type, humans developed modern high-producing breeds. Today's Angora will give 10 kg of mohair each year; the Boer (a South African meat goat) grows quickly and reaches 100 kg liveweight. Common dairy breeds can produce well over 1000 kg of milk in 10 months.

The goats we see in Canada are almost exclusively derived from the dairy breeds of Europe. We imported the French Alpine, Saanen, Toggenburg and Oberhasli dairy breeds directly from Europe. The Alpine, of course, came from France; all colors and combinations of color occur in the breed. The Saanen originated in the Saanen valley of Switzerland, and has become the most widely distributed of the improved breeds because of its large size and excellent production; it is all white or cream. The Toggenburg, from northwest Switzerland, is a brown goat with white markings on face, rump and legs. The Oberhasli, recently recognized in Canada as a separate breed, derives from the Oberhasli-Brienz goats of the Swiss Alps. Even the Nubian underwent most of its development in England.

Under good management, these breeds produce extraordinary quantities of milk. Exported to the Third World, they give much less milk than they do in Canada, but still outproduce native goats by many times. Bred with local goats, they have already improved the next generation's output in those countries.

The need for goats' milk is not restricted to Third World countries. In Canada, many families keep goats for their own milk supply. Goats are in many ways easier to handle than cows, need less feed and produce a more manageable amount of milk.

Milk from well-bred, healthy goats is virtually indistinguishable from cows' milk in taste. Many people who are allergic to cows' milk can digest it without a reaction. The milk also lacks the agglutinin that causes cream in cows' milk to

gather and rise to the top, giving us a naturally homogenized product. Goats' milk forms a softer curd that many people find easier to digest. Its unique texture and flavor under culturing make it a vital ingredient in many cheeses.

Whether kept for commercial production or a family milk supply, it makes sense to own goats that produce well. You can find excellent genetic material in any of the Canadian dairy breeds, and good management and nutrition will help these animals produce their potential. A poor producer costs almost as much to keep as a good one, but a healthy, high-producing dairy animal will repay your investment many times over.

SIZE OF OPERATION

This is one of the first things you have to decide. For a family milk supply, two good does that freshen (renew their milk production after giving birth) at different times of the year may prove sufficient. A doe that produces 1000 kg of milk in a 10-month lactation will most likely peak at around 5-5.5 L per day in the second month after freshening, then decline at about 10-15% per month after that. Thus, a doe giving 5 L a day in May will probably give 2.5 L the following October or November. In Canada, the vast majority of goats freshen in March, but you can easily freshen one any time from February to July with very little effort. With one doe fresh in February and the second fresh in July, the milk supply should be somewhat steadier.

You may feel more secure with three or four does, in case one develops a problem, but unless you have a use or market for the extra milk, this is just not economical. Goats reproduce rapidly and kids usually become milkers within a year or two. You must decide how many goats to keep and stick to this number; overpopulation in the goat barn is unhealthy for the animals and highly frustrating for their keeper.

If you want to become a commercial producer, you will face the same problem. A steady flow of milk is important to the marketing of fluid milk, yogurt or cheese; in fact, milk and milk products are in greater demand in winter than in summer. You should freshen a larger number, if not most, of your does as late as possible up to October and November so production will suit your markets.

Unless you have had extensive experience with dairying in general and goats in particular, you may take on more than you can handle. Try a year or so of milking about 10 animals to get some idea of what you may expect with a large herd; if you are still interested in milking 50, perhaps you should take the plunge. The 10 does will likely be a good start on a commercial herd if you have generally been pleased with their production, persistence and health. If you decide

against going commercial, you have enough animals from which to select for a good small herd.

Many factors often discourage people from starting a commercial herd – unreliable hired help, animals that don't meet expectations and herd health problems, to name a few. A fairly large gap in economic feasibility separates the herd of four milkers and the herd of 50. The milk from 10 does is often too much to use, but not enough to sell. However, the breeder who wishes to keep purebred show animals, relying on the sale of breeding stock to pay the bills, may have to keep 10 or more does to make any progress in improving the stock. Without milk sales, this breeder will have to face net losses for at least the first few years, until a good name is established.

MARKETING

If you produce milk for sale, you must follow milk marketing regulations in your target area. Most municipalities and countries have rules against selling raw milk, and even pasteurized milk must be handled in a specified manner to prevent contamination before the final seal goes on the package.

Milk may become contaminated in any number of ways. The animal herself, even though apparently healthy, may shed organisms such as toxoplasma or salmonella into her milk; she does this only intermittently, so they are difficult to detect by spot-checking the milk. Low-grade mastitis often remains undetected for some time, even if you make regular somatic cell counts or California Mastitis Test (CMT) checks on the herd. The milker's hands, the milking machine, or even the air of the milking parlor can carry pathogens.

You or your family may be immune to all or most of the pathogens in the herd and environment, but you can't be sure that every person who buys milk will be. In fact, customers for goats' milk are often those most at risk from disease – infants, the aged and the ill. You have a duty to deliver only the highest quality, cleanest product to your customers, and that means *pasteurization!* The cleaner the milk is to start with and the sooner after milking it is pasteurized, the higher its quality.

Pasteurization heats milk to a temperature that kills almost all bacteria, then cools it rapidly to prevent the development of off-flavors and bacterial regrowth. Certain enzymes in the milk also become inactive, including lipase, which causes "goaty" flavor.

Some areas still let you sell raw milk to customers in containers they themselves supply, if

they pick it up at the farm. We cannot recommend this practice. In fact, it might even be a good idea to buy a home pasteurizer for milk used by your own family, even if you don't suspect a problem.

Commercial processors are obliged to pasteurize all milk destined for retail. Most cheesemakers also pasteurize milk before processing, simply to be sure of unadulterated cultures.

Canadian milk-production regulations originate with the provinces, to make milk safe for the consumer. However, the regulations can also guide you in producing high-quality milk with the least effort possible. By following building specifications and cleaning recommendations, you will save time, energy and, ultimately, money. If no hard-and-fast regulations for goat-milk producers exist in your area, follow those for producers of cows' milk.

Few producers can afford a processing plant. In fact, most herds of a manageable size cannot produce enough milk within 2-3 days to fill the pasteurizer in an average processing plant. Therefore, several producers must cooperate by shipping their milk to the same plant if they want it processed economically.

Under most processing arrangements, the processor markets the finished product and needs a steady supply of good-quality milk; the producers must be willing and able to provide this. Although an attractive package will entice new customers, the product must also be available and of consistent flavor and texture if the market is to remain captured.

Meat kids and breeding stock

In any dairy operation, a kid that you don't need as a replacement can become a liability. It must be fed, which makes demands of both time and equipment.

Producers who sell surplus kids for meat often raise those born during the summer to market weight by letting them nurse on their dams, if the milk is not wanted. This saves labor but can be somewhat hazardous, in that udder health is not monitored very closely and mastitis may result. Therefore, many producers sell their 4-day-old cull kids for a reasonably low price to anyone willing to raise them for meat.

No matter who raises the kids, the markets must exist. The markets for goats' meat are not as organized as those for beef or pork, although abattoirs will often buy kids just before Easter or Christmas. At this time, they like a goat about 20-25 kg liveweight. At other times of the year outlets may be scarce.

To retail meat, the animals must be slaughtered at an inspected abattoir. If interested, you might contact a small packing plant to see if it will set aside one day each week or month for butchering goats; you will probably also have to set up the retail markets. You will have to guarantee to deliver a certain number of animals or quantity of meat, and will have to accommodate buyers' tastes. Fortunately, there is a growing interest in chevon (goat meat) in Canada.

There is also a definite market for breeding stock, but here the competition is fairly fierce. Occasionally, you can sell recorded grade kids from proven high-producing and well-bred dairy sires to family operations, but the more lucrative demand is for purebred and Canadian of Breed animals for show and milk. Buyers will want to see proof of high production in the form of milk records; buyers at a distance will appreciate having information from classification records and show wins. The more information you can provide about your stock, the more likely you can satisfy your customer's needs. Don't discount advertising as a way to get this information out to prospective buyers – ads placed in breeders' magazines will help.

Whether you raise purebreds or grades in a small or large operation, you will have to cull the occasional doe. Chronic mastitis, low production and reproductive problems are perhaps the most common reasons for getting rid of a particular animal. Never sell animals with problems like these as anything but meat. If you take the doe to the local auction, identify her as a cull. If you sell her for meat, be sure the buyer knows if she has been treated with antibiotics; even better, wait until the withdrawal period recommended by the drug manufacturer has elapsed. Of course, you may use the animal yourself – even a very mature animal will give you excellent stew meat.

HOUSING

Barns

Most goat enthusiasts fix up an existing shed or building to accommodate their first animals. The building must be dry inside; not only do goats hate to get wet, but will actually get sick if they can't get out of the damp and drizzle. The walls, too, should be solid enough to prevent drafts. The building need not be insulated, since goats are reasonably tolerant of cold temperatures, but adequate ventilation is a must. A very snug, airtight building will permit moisture buildup and condensation inside, causing respiratory problems in the goats.

A barn in a dry, well-drained area does not need a floor. In fact, a wooden floor may rot and develop inconvenient holes, and a concrete floor is cold and damp. If a concrete floor is already in

place, you will have to provide enormous amounts of bedding to insulate the goats in the winter, or build wooden sleeping platforms. Alternatively, you can frame a corner or side of the building to make a sleeping area that can be deeply bedded.

Figure 1 A sleeping platform

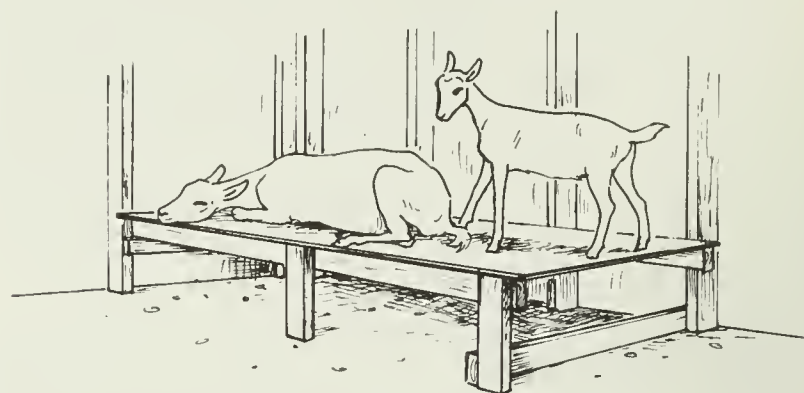
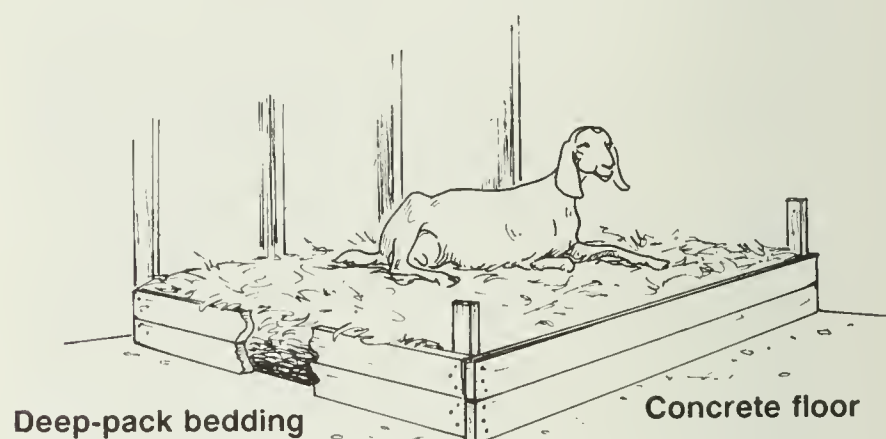


Figure 2 A deep bedding pack



You will want at least a small exercise yard outside the shed. Although you can tether a goat for a short time if she is used to it, this is not recommended unless someone is on hand at all times to untangle her, move her to fresh grazing, and bring her in out of the rain. Since goats really prefer browse to grass, it's difficult to keep them from getting their tethers hung up. The one exception to the don't-tether rule might be the buck that won't stay in his yard.

The exercise yard will be in use for a long time, so build a sturdy fence around it. One 122 cm high is adequate for most does. It will need at least two gates, one to let the does out to pasture and one to let you in. Several types of gate latches work for goats, but place them where the goats can't reach them. Make the gates wide enough to let a wheelbarrow pass.

Feeders

You must provide a feeder for hay and a small box for the salt mineral mix, preferably inside

the shed. If you plan on feeding grain outside the milking parlor, you can place it in the same area.

A thing to remember about feeders – it's nice to have them where you can fill them without

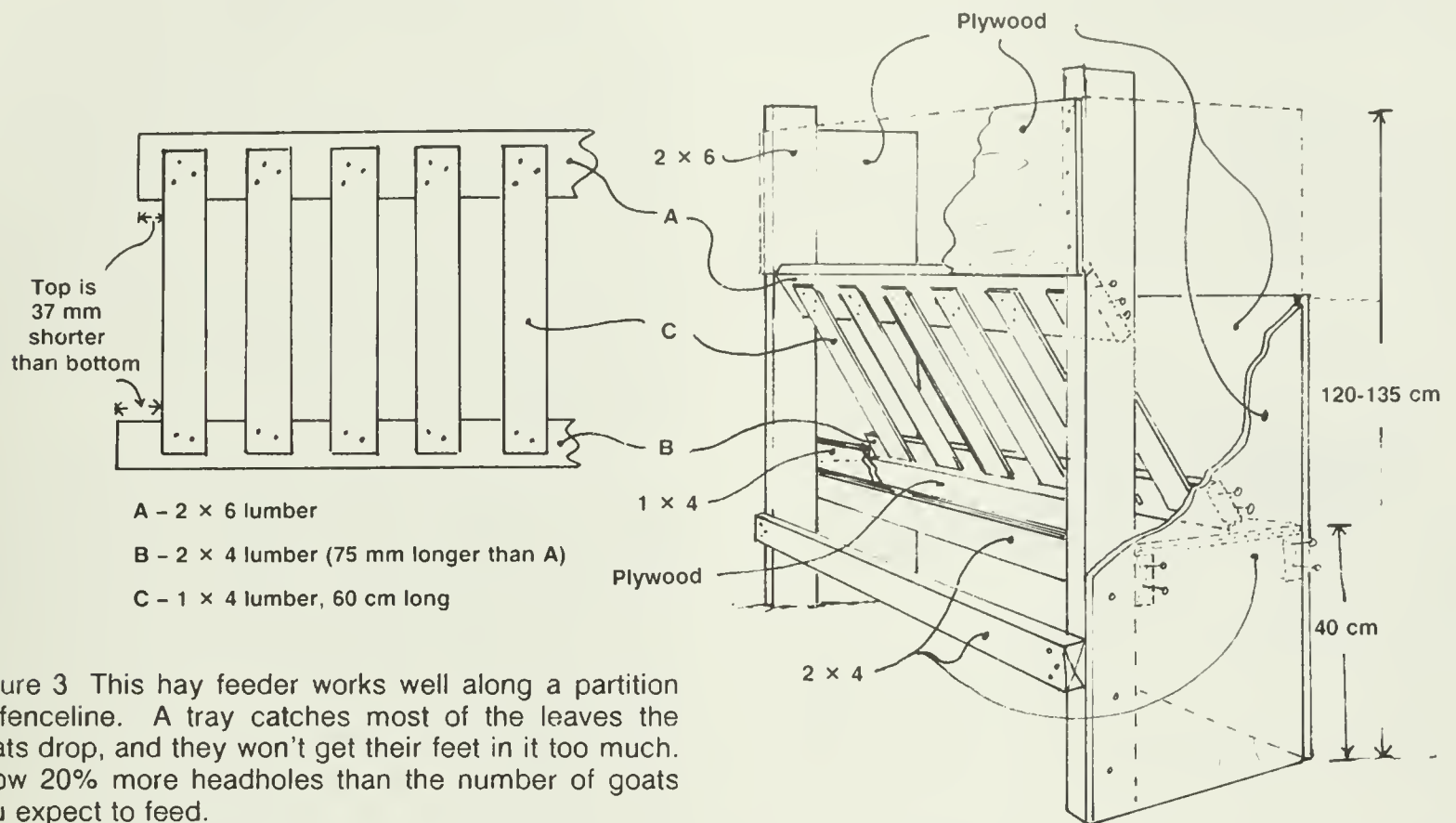
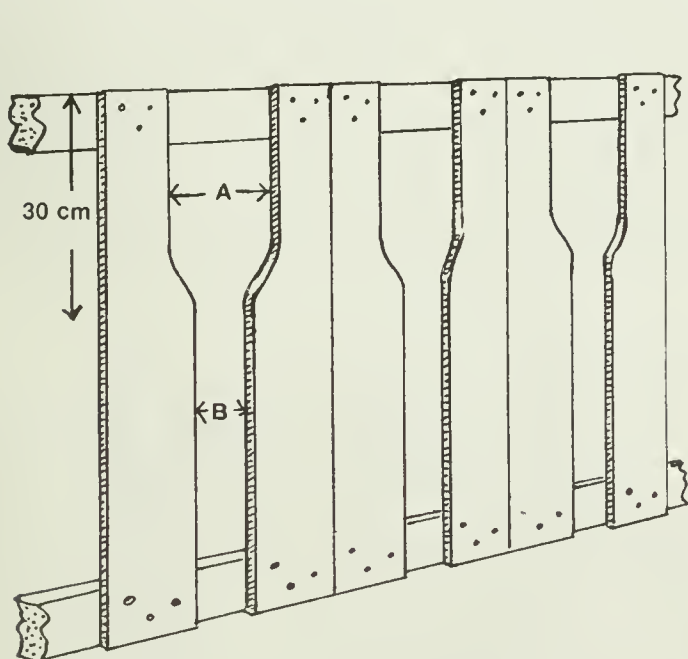


Figure 3 This hay feeder works well along a partition or fenceline. A tray catches most of the leaves the goats drop, and they won't get their feet in it too much. Allow 20% more headholes than the number of goats you expect to feed.



A – 22.5 cm for bucks, 20 cm for does, 15 cm for kids
B – 15 cm for bucks, 10 cm for does, 7.5 cm for kids

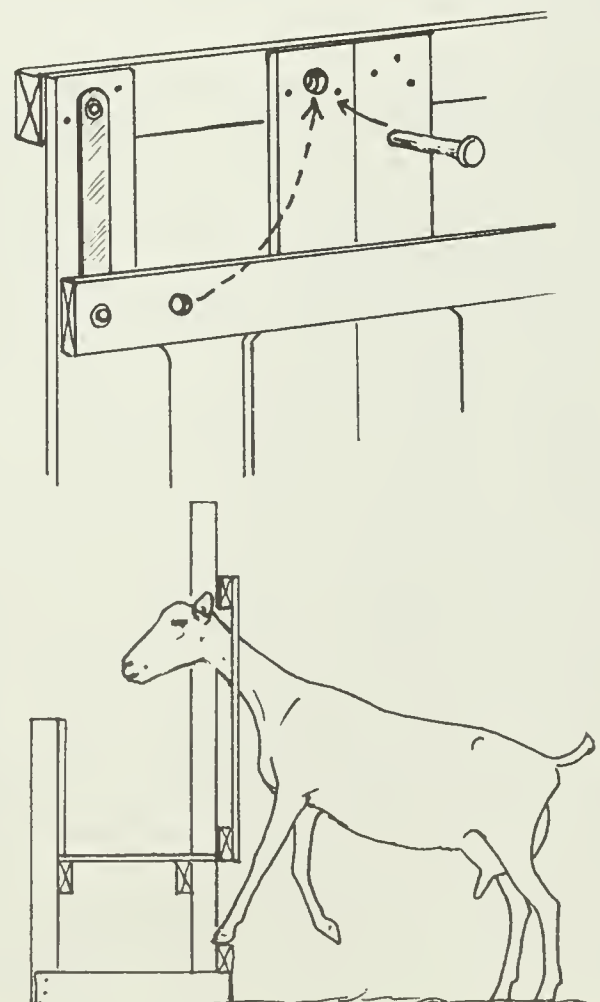
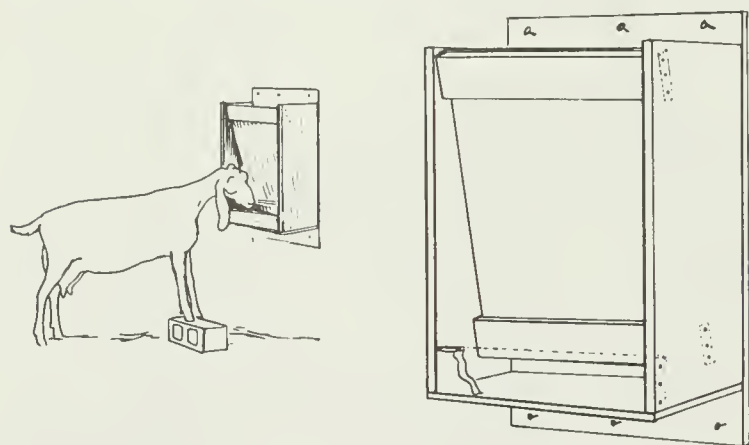


Figure 4 You can use a keyhole feeder for either hay or grain. The drop rail minimizes bullying. If you want to feed goats from both sides, increase the width to avoid fighting.

having to get in the pen with the goats. There is nothing quite so frustrating as wading through a mob of frantic goats with a bale of hay balanced on your shoulder.

If you have to place the feeder outside, be sure the feed bunk is covered. The goats appreciate being covered as well, or they won't eat on rainy or snowy days, and you must keep the feed, hay or grain from becoming damp to prevent toxic molds from growing.

Figure 5 The hopper feeder is ideal for the salt-mineral mix. Place it high enough to keep the goats from standing on the top, but low enough that they can feed when standing on a block.



Fences

Board fences, if high enough, keep goats in their pens, but are expensive. For this reason, you may wish to use one only around the barnyard and in high-pressure areas (pens near feed storage, kid weaning pens and buck pens). Although a height of 122 cm will hold most goats, the occasional yearling buck will prove quite talented at jumping; make fences around buck pens 150 cm high. Be prepared to add a wire even above that, so use good long posts.

Page wire (farm fence) can be a good material to use around larger pens, particularly if you can attach it to boards top and bottom. By itself, it is vulnerable to goats that stand on it or rub their bodies along it, stretching the wire until it sags enough for them to walk over. If you use too light a gauge of wire, goats will be able to stretch the holes and you'll find kids running in and out.

One solution to this problem makes a very secure fence – page wire with electric reinforcement. By running an electric wire 5-8 cm inside the page wire and 30-42 cm above the ground, you discourage the goats from standing or leaning on the fence. Another electric wire 8-10 cm above the page wire has shown good success at

stopping the jumpers, especially once they've had a good shock from it. This setup makes a good training fence because it teaches goats to respect electric wires. When they get a shock, they cannot barge straight ahead as they are inclined to. After being behind a page wire and electric fence for a week, most goats become quite manageable behind electric alone.

Electric fencing is one of the marvels of the modern age. Once trained to it, a goat will ignore almost anything on the other side. One great advantage is that you can see everything through it; you can watch your goats without disturbing them, and observe for unusual behavior that signals sickness or does in heat, or just for enjoyment. A disadvantage is that you must keep vegetation trimmed away from the wire. A good nylon cord trimmer, preferably gas powered, is well worth the investment; chemical control of the fence line weeds is expensive and can be dangerous.

Even if your fencer (the apparatus that sends current to the wires) is the type sold for use without insulators, use insulators. Goats need a heavy shock they can notice, and stapling electric wire to posts just wastes power. Also, be sure to find out if your fencer is the type that can use the new poly-and-metal wire; "weed-burner" fencers work only with real wire. Sixteen-gauge wire (smooth, of course) is easy to handle, but uses springs to keep the wire stretched tight. The wire will expand on hot days, and contract on cold days.

Never use barbed wire anywhere the goats can go through it. Goats don't mind the odd scratch, and will go back and forth through barbed wire until they rip an udder open – after they heal they will go back and do it again. The best thing to do with barbed wire is to take it down. Give it to your neighbor with the cattle. Your electric wire will keep the cattle out of your place, too.

Waterers

Automatic waterers are wonderful. You just have to keep them clean. If you can't afford one right away, at least make sure the goats have access to clean water all the time. In the winter, unless you can take fresh warm water out every couple of hours, you will find it worthwhile to invest in a stockwater de-icer. This will keep a tub of water just above freezing so that the goats can drink at will. Insulation around the tub will help keep the hydro costs down.

Keep the water out of harm's way behind a keyhole or two (see figure 4). A goat may accidentally back up to the keyhole to deposit manure, but with luck this will rarely happen. Make the water tub easily accessible for removal and cleaning.

Milking area

You must have a quiet place to milk, away from the herd. This should be a special area, uninhabited by goats, that you can keep reasonably clean. Most goats that are used to being milked will not drop manure in the milking parlor if they can help it, but will still track in a certain amount. A floor in this area is definitely an asset to cleanliness.

One thing you will want as soon as possible is a milkstand. This will help keep the milk clean and avoid cramping you. Some people like to milk from one side, but alternate sides if at all possible, for the sake of your own back. The goats get used to it quickly enough.

Goats can be milked by machine and, if you are milking more than nine or 10 does, it may be something you will consider. Goats require less vacuum than cows – 25-30 cm is OK; pulsation rate may be 55 at 25 cm, up to 65 at 30 cm. Lightweight claws are available for use with goats. Consult your local milking machine dealer; he may be able to find a machine you can use, or adapt one you already have. Cleanup is especially important when using a machine.

Figure 6 A folding single milkstand

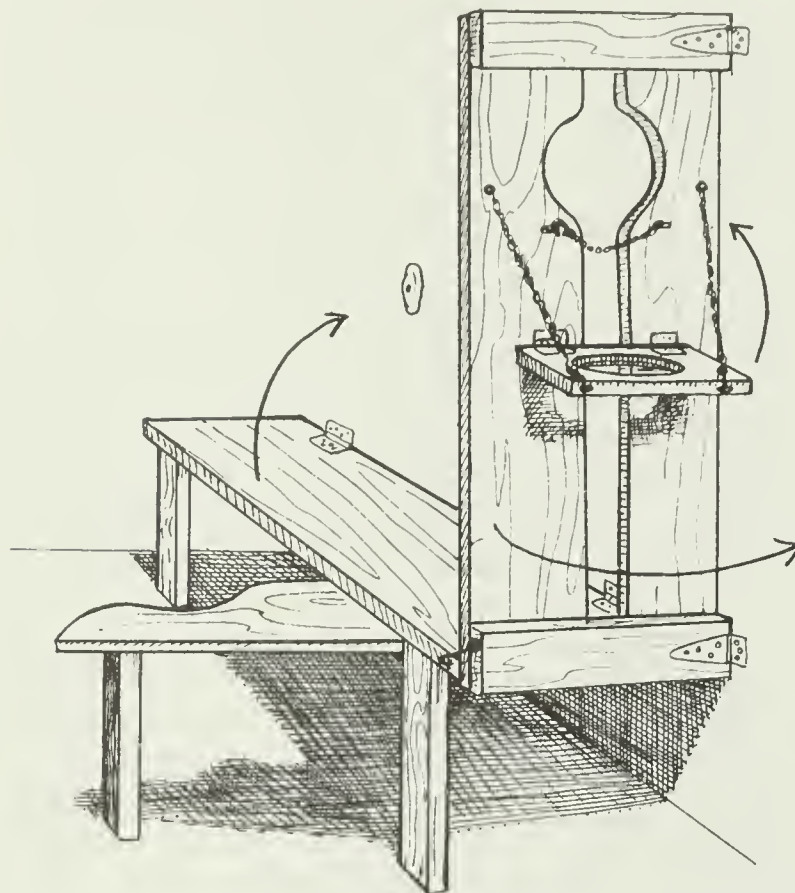
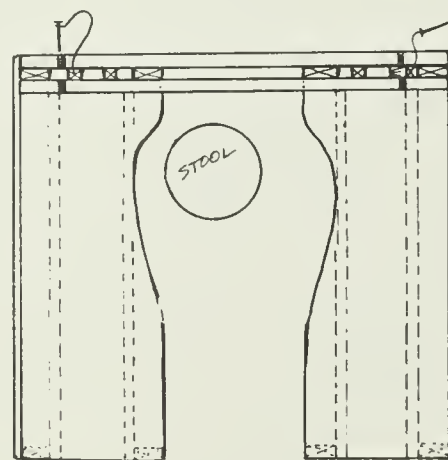
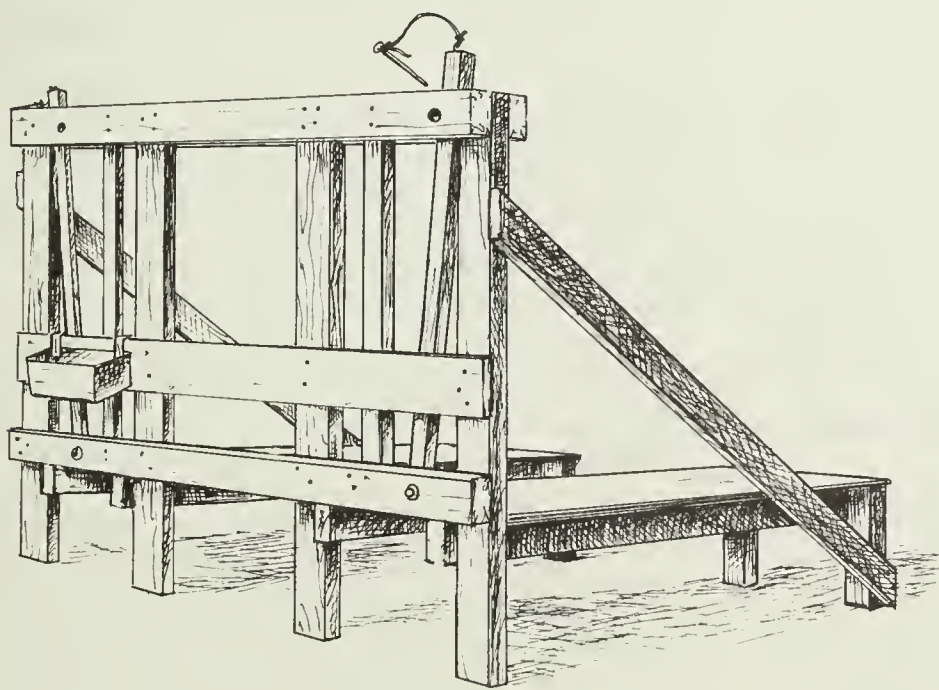


Figure 7 A double milkstand



Upgrading your operation

After you've lived with your first makeshift barn for a while, you may wish to upgrade or expand the operation. By this time, you will have learned how you like to do things, what works for you and your goats, and where you need more convenience.

Figure 8 shows the usual flow of traffic. Even if you have only four does, you will have to perform most of the functions shown. It would be nice to have a special area and pens for each different feeding group, but you probably will have to double up in a few areas according to your means. You need the kidding pen only a few times a year, so the rest of the time it could function as a treatment area or hold the weaned kids. Be sure to clean a pen out, though, before any function if you have been using it for something else the interval.

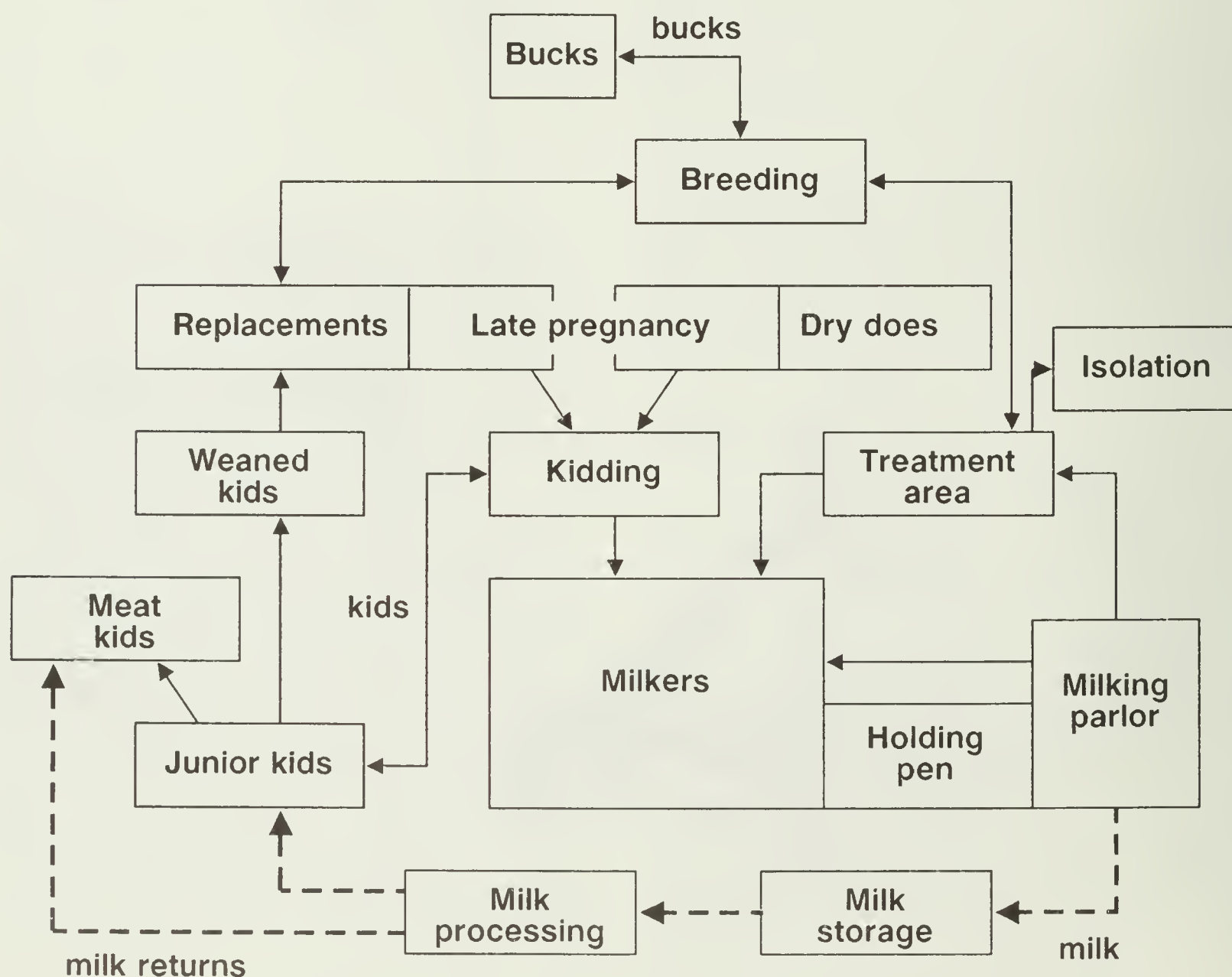
The first requirement is a barn for the milking does. You may prefer loose housing, free stalls or stanchions, but your herd must have dry,

draft-free quarters where they can eat and rest. Each milking doe should have 1.8 m² of space in the barn.

If you have a small herd, you may dispense with the holding pen, but in a larger herd it is a great convenience. Occasionally, a senior doe may become upset because you milk a yearling before her, and you can't spend too much time chasing her around to get her into the milking parlor. Make the pen just big enough for the animals all to stand at once (0.5 m² or slightly less per animal) and crowded enough that they want out.

If there is any chance that you will expand your herd further, plan for it before you build a new milking parlor. This is the area that costs most per square metre, and will be most expensive to enlarge later. Build as big as you can afford now – you can always use a little extra space here anyway. Allow enough milkstand length to accommodate at least twice as many does as you can milk at once, to give them time to eat enough grain. You can use a corner of the

Figure 8 Traffic flow in a dairy operation



milking parlor as a treatment area; a place to tie a doe or two for a few minutes will suffice in a small herd.

Have the treatment area handy to the milking parlor because that will be where you catch the largest number of problems. Also, you will probably keep medications, hoof trimmers, record charts, etc. here. You won't want to stop for these operations in the middle of milking, but if the doe is there staring at you afterwards you will more likely get around to it.

Don't skimp on the isolation area if you can help it. Isolate any doe that shows up with what might be a contagious condition. This doesn't mean you can't make her comfortable – sometimes all she will need is a little time to herself. The rest of the herd is important, too, so find another shed somewhere and keep it ready if you need hospital space.

If you use or sell the milk, you will have to feed your milking does for production. This is not what you want to feed your dry does; they will do best on a clean, coarse grass hay fed free-choice, and, later in their pregnancy, some grain. For this reason, you must separate the dry and milking animals when they eat. You can have an area to house each group, or simply separate them once a day. With the second solution, give the milkers a good feed of alfalfa for 30-45 minutes before you let the dry does into the feeding area. If the dry does eat the leftovers, they will probably find nothing but stems, and that won't do them any harm. If this is the route you choose, be regular about the time of day and the amount of alfalfa you feed.

Kidding stalls must be clean when the does go in, preferably just a few hours before they kid. If you don't intend to raise the kids on a pasteurized milk program, you can leave them with the doe for 3 or 4 days, until her milk can be used by people.

Group kids according to size and maturity. If you prefer to let the does suckle their kids, have a place to keep them apart. Replacement kids should not have access to unlimited milk, but it is the fastest way to raise meat kids. Therefore, while you will wean replacements rather early, you will wish to keep feeding the meat kids milk until they reach market weight.

If you decide to keep a buck, but don't want all your does bred at the same time, you will have to give him his own housing, feeder and water supply. A 150 cm fence should keep him away from the does, but if it doesn't you will find out when one of the females comes into heat. Then you may decide to run a board or an electric wire along the top of the fence. Then again, you could try tethering him to a wire that runs from his shed to his feeding-watering area.

If you decide on more than one buck, you can keep them together, as bucks enjoy each other's company most of the year. Some breeders give bucks separate runs where they can only visit through the fence, since certain diseases may spread by homosexual activity; ureaplasmosis, for example, may later cause a vaginitis in bred does. However, goats spread few diseases venereally.

While you can turn a doe in heat in with a single buck, breeding is not quite so simple when several bucks are kept together. If possible, provide an adjoining area for the buck you wish to use, let him into it alone, and then introduce the doe. In season, even mild-mannered bucks can become very difficult to handle so the easier you make this process on yourself, the more success you will have.

Electricity

Milking, of course, requires electricity, as do many other operations you perform in the barn. Be careful if you do your own wiring. A barn requires special wire that can resist dampness; never use a makeshift system of extension cords. Improper wiring and short circuits are a major cause of fires, especially in the winter when the goats are helpless prisoners in the barn. Be very careful with heat lamps, as well. Goats need them on very few occasions, so if you can't be perfectly sure they're safe, don't use them.

SELECTING THE RIGHT GOAT

To rank beginners shopping for their first goats, all goats look the same. Once they get the goats home, they find it easier to see their faults. In fact, they may see nothing else.

There are no perfect goats. However, it is perfectly permissible to have minimum standards in certain characteristics, to be happy with the animals that meet those standards until all in the herd do so, and then to revise those standards upwards to meet your breeding goals. Even if your doe is not perfect, she may have many good points that she can contribute to the next generation through selective breeding. You can arrive at an impartial assessment of her qualities and faults through milk production records, classification sheets and records of her offspring.

Ideally, you will read this before you buy your first goat. In reality, this will probably not be the case. You may be trying to decide whether to keep or cull her, or whether to keep her daughter as a replacement, or sell her son for breeding stock. Or you may be looking for another doe or buck to add to your herd. In any case, consider the following:

Figure 9 A correct doe

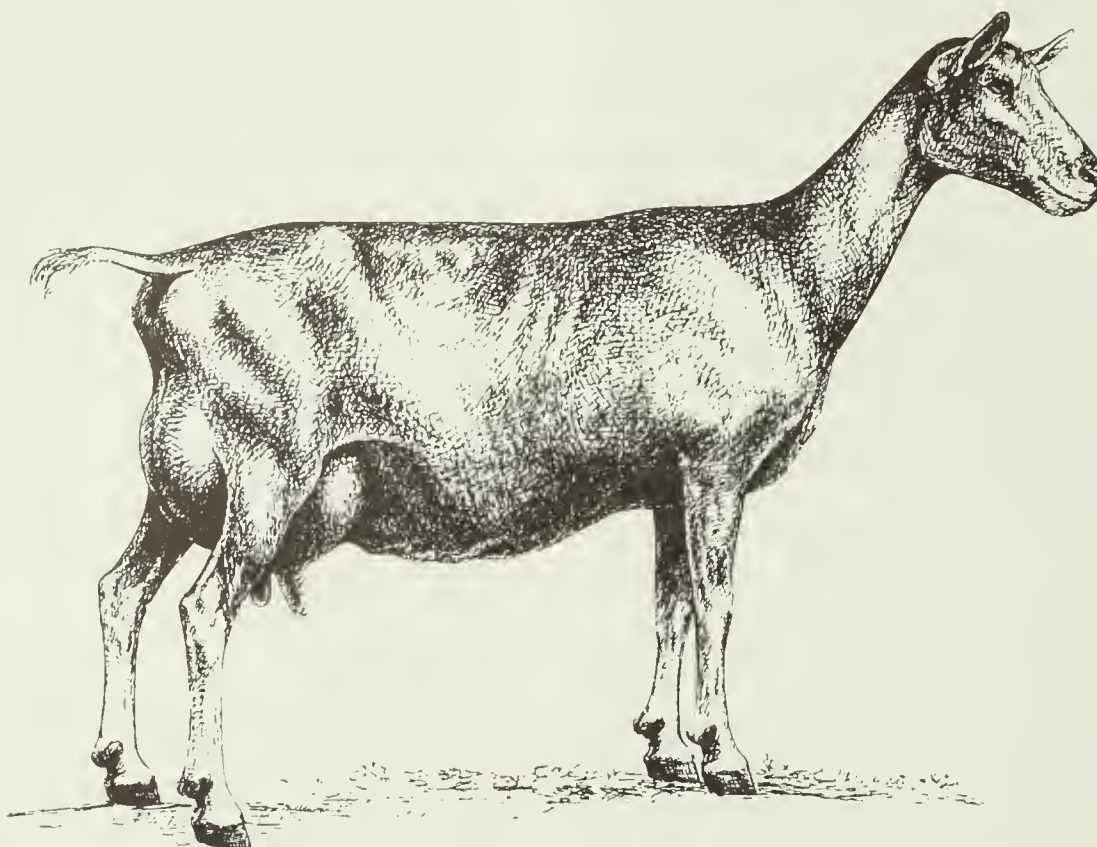
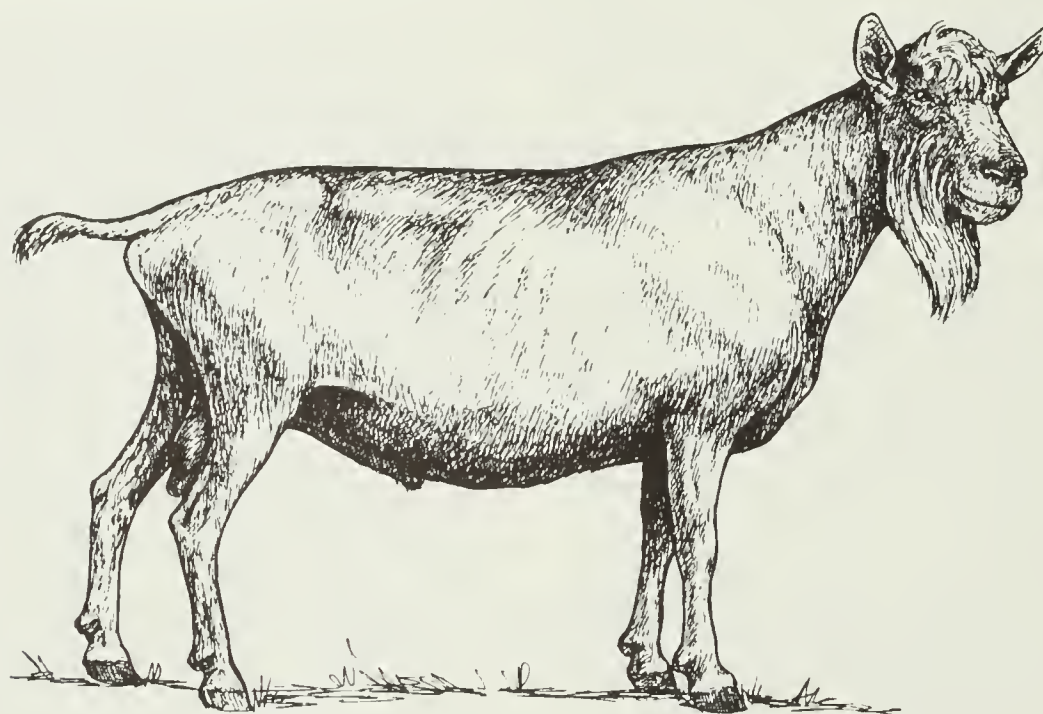


Figure 10 A correct buck

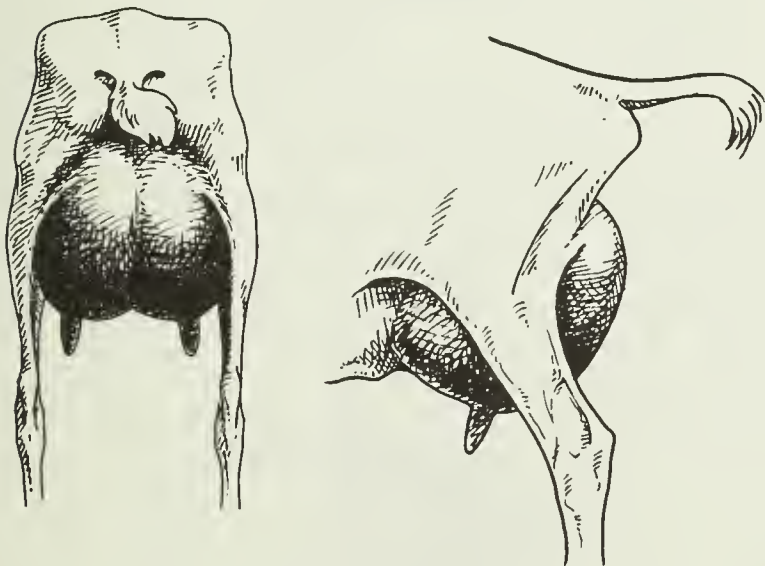


HEALTH A healthy goat is alert, lively and graceful, and has a glossy coat and loose, pliable skin. Never buy a goat because you feel sorry for it, unless you know exactly how much time and money you risk, not to mention the health of your herd. Please check for signs of lameness, enlarged joints, mastitis, malnutrition, diarrhea or abscesses in the animal or its herd.

PRODUCTION RECORDS If available, examine the production records of the doe herself, or the records of her nearest relatives – dam, sister, etc. When did she freshen first, and at what age? How much milk did she give then? In her later lactations? Or her latest test? What is her average butterfat percentage? What weight of protein per lactation or per test? How does she rate in the herd? If known, what is her somatic cell count? These are questions you should ask, and producers who can answer them will be glad you did.

UDDER Again, the nearest relatives will give you some indication of what to expect if the animal doesn't have an udder yet, or at the present time (don't forget to ask about reproductive history – how long has this doe been dry?).

Figure 11 A good udder, attached tightly on the sides and high and wide at the rear, suspended from a wide escutcheon



The udder should be well attached, high and wide in the rear, extending well forward in the front, with well-delineated teats of convenient size for milking. It should be capacious and well supported by the medial suspensory ligament. A

pendulous udder is more susceptible to injury, thereby shortening the productive life of the doe. When the udder is milked out, it should be soft and pliable, free from excess flesh; check for hard lumps that could indicate previous mastitis problems that may recur.

Figure 12 A very pendulous udder, held only by strings of skin and connective tissue. The stretched medial ligament lets it hang dangerously low.

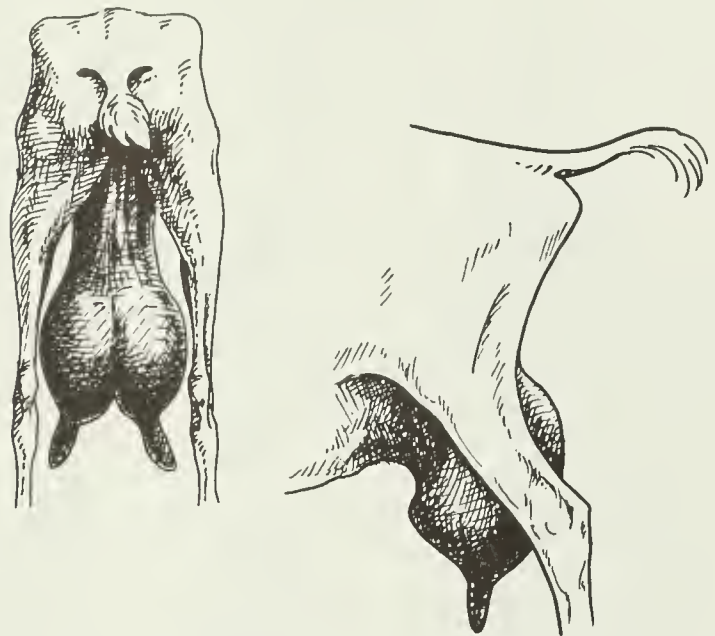


Figure 13 A weak medial ligament lets the whole udder fall down at the center, leaving no division between the halves; the teats point up and sideways and the rear attachment is giving way under the strain.



DAIRY CHARACTER A dairy animal should be sharp and free from excess flesh (particularly in the first half of lactation). She should have a long, lean neck and withers and hips that are sharp and angular.

Figure 14 Shoulder types

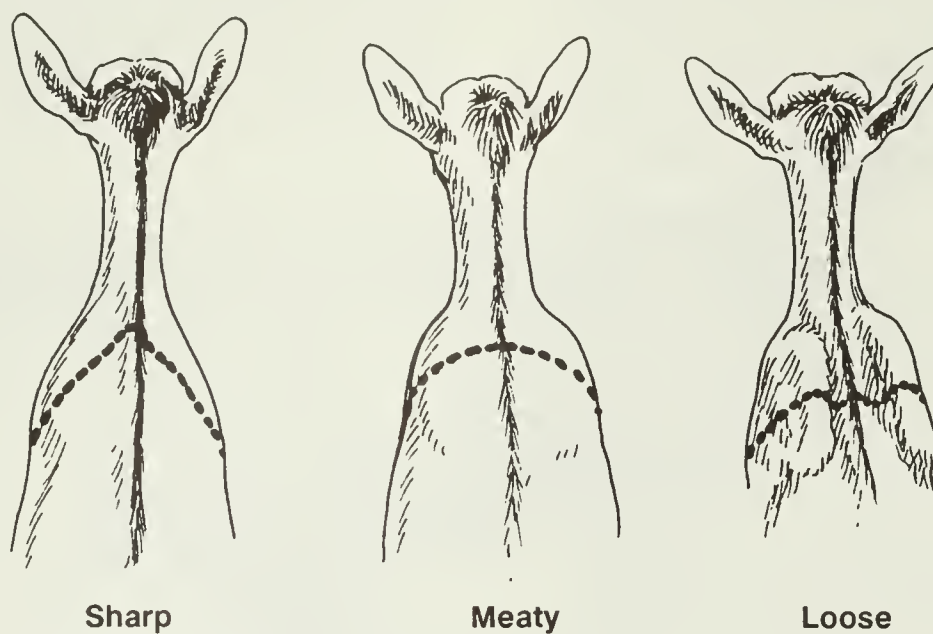


Figure 15 Hip types

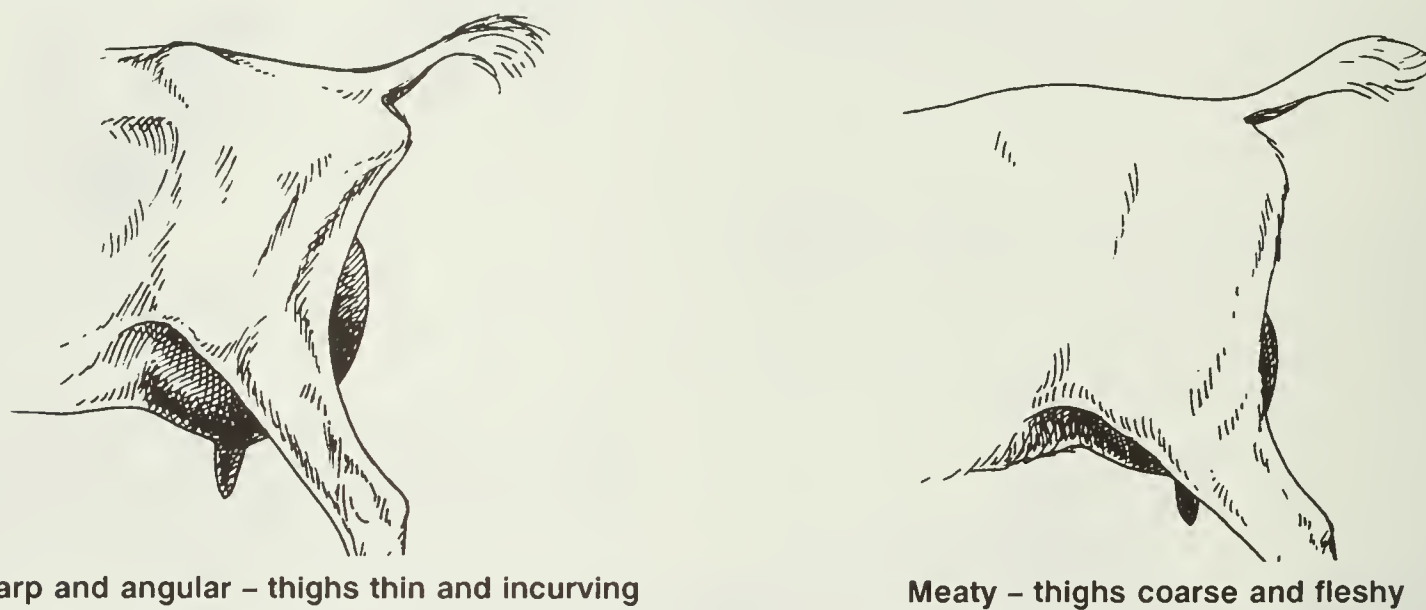
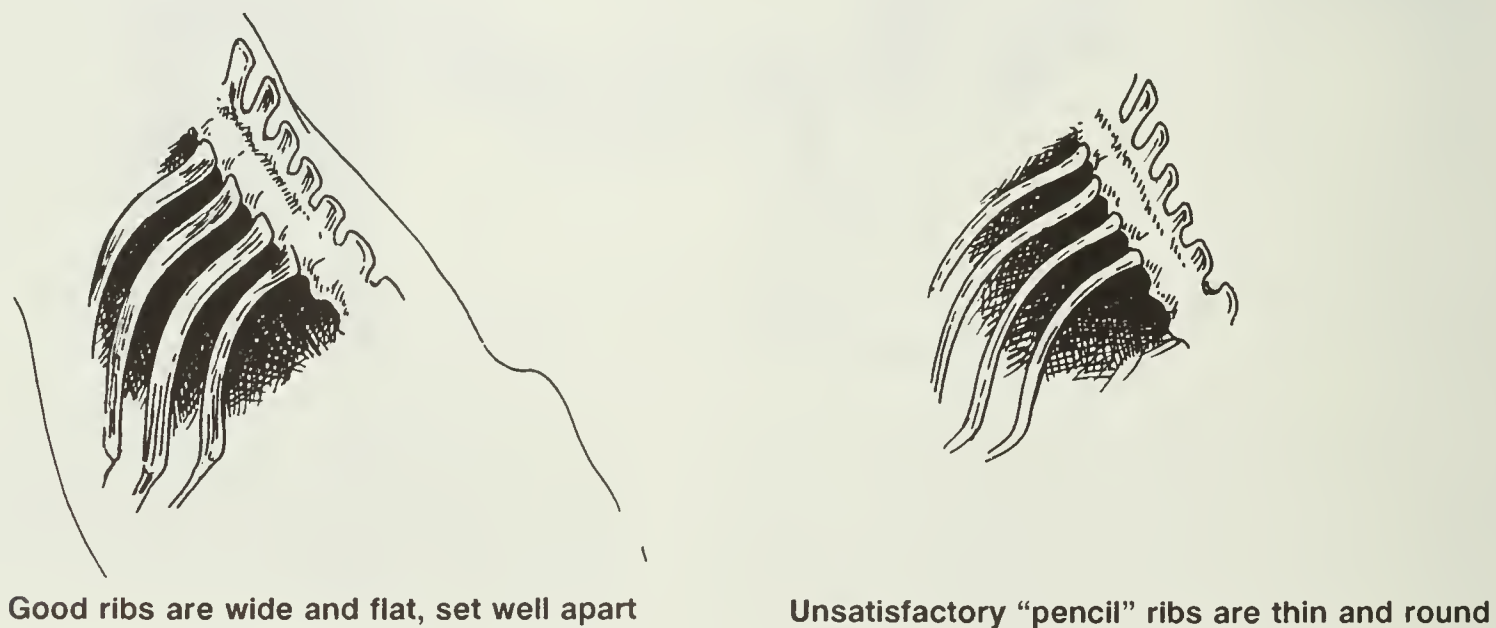


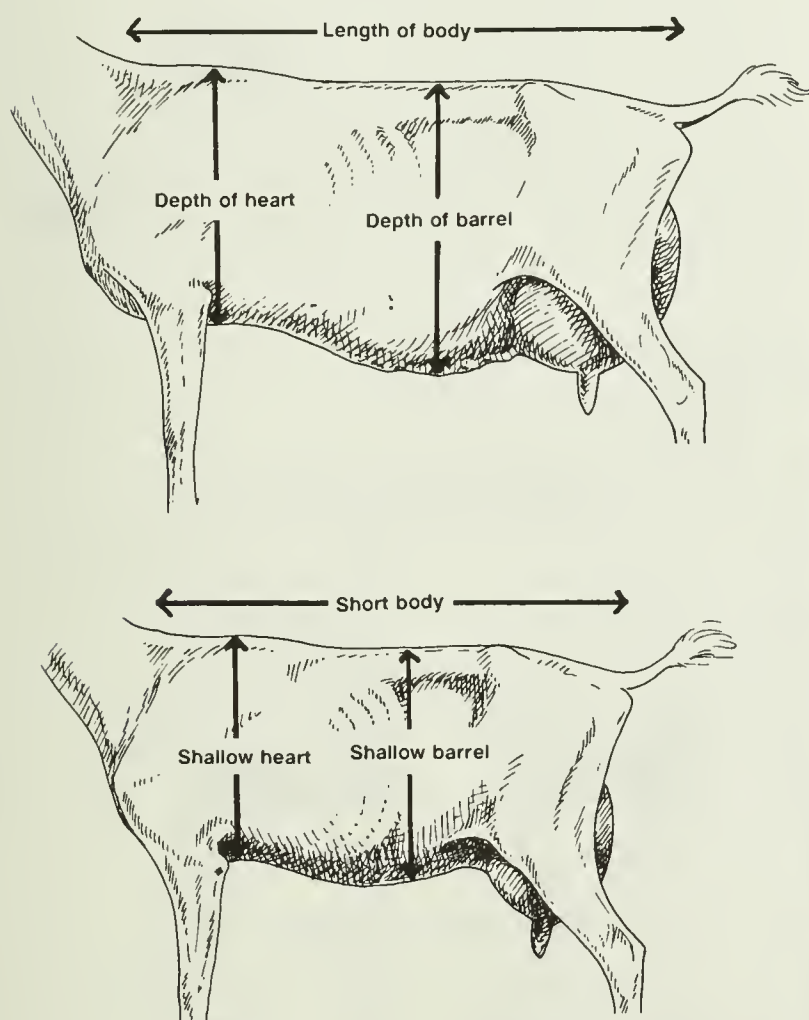
Figure 16 Rib types



Ribs should be wide, flat and widely spaced; flat bones may also be seen in the legs, which should nonetheless appear substantial if somewhat flat in cross-section. These characteristics indicate a doe that utilizes her feed for milk production rather than to put flesh on herself.

BODY CAPACITY The doe that eats more can produce more milk. Look at length and depth of body, spring of ribs and depth in the heart area. Avoid a pinched heart girth, which inhibits respiration and, therefore, metabolic function. The ideal body is wedge-shaped, increasing in volume from the front to the rear, from a generous heart girth to a deep flank, and from sharp, flat shoulders to a wide, well-sprung barrel.

Figure 17 Seen from the side, a good dairy goat (top) has a long body, deep barrel and good depth in the heart area. A poor doe (bottom) is short and shallow, with crowded heart and lungs and no volume in the digestive system.

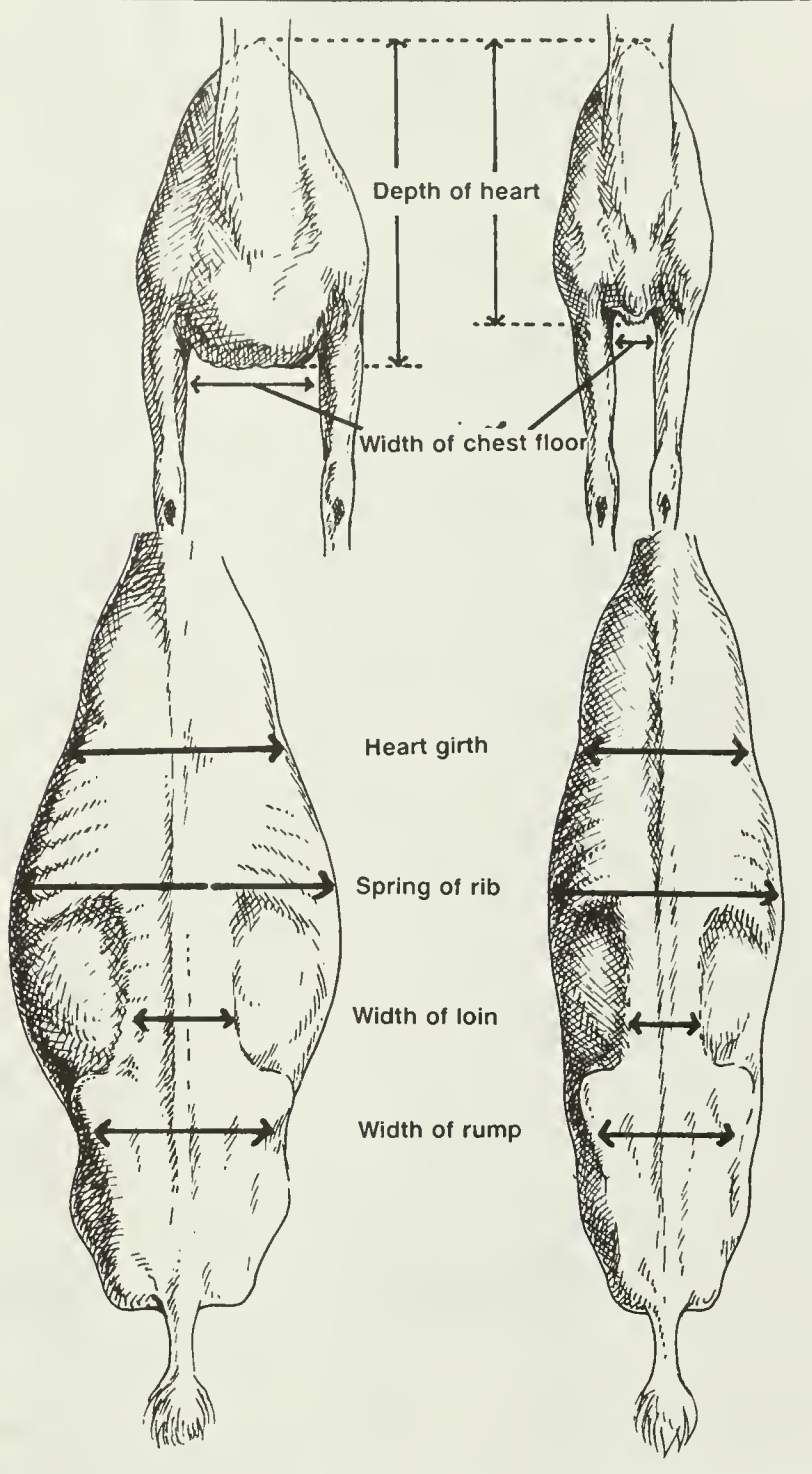


LEGS AND FEET These should be strong, straight, and free from swelling at the joints. Her legs and feet carry the goat through her life, to

her feed and to the milking stand, and they must be structurally sound.

Enlarged knees, enlarged stife or hock joints, broken pasterns, posty rear legs or loose shoulders cause pain, stress and lost production early in life.

Figure 18 From the front and top, the difference between a wide doe with good body capacity and a poor narrow doe become obvious.



A narrowness in the escutcheon puts downward pressure on the udder, causing early breakdown of the udder attachments; legs close in the hocks bump the udder as the doe moves, subjecting it to unnecessary injury.

Figure 19 Forelegs and feet

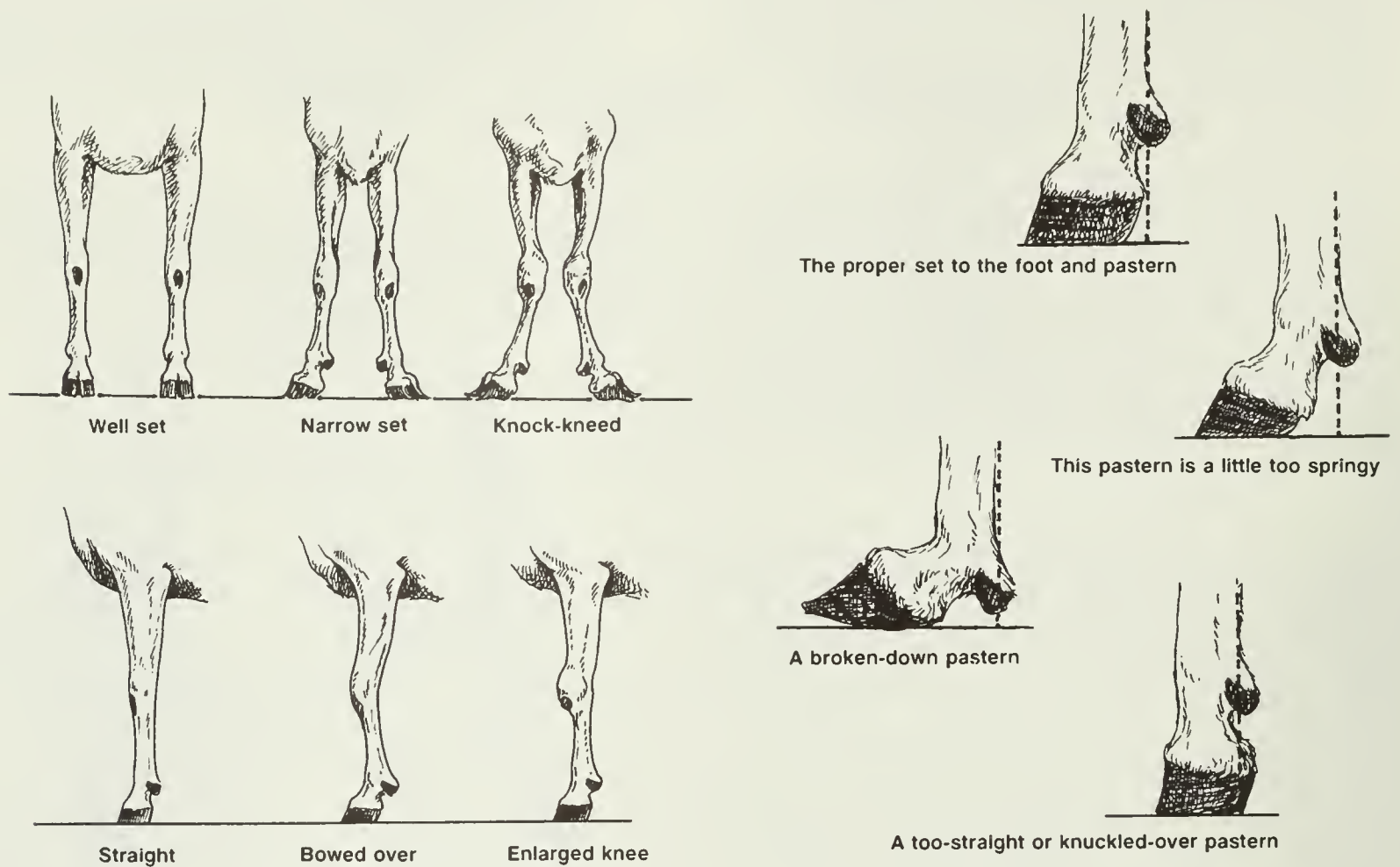


Figure 20 What to look for and what to avoid in the doe's rear legs, as seen from the back

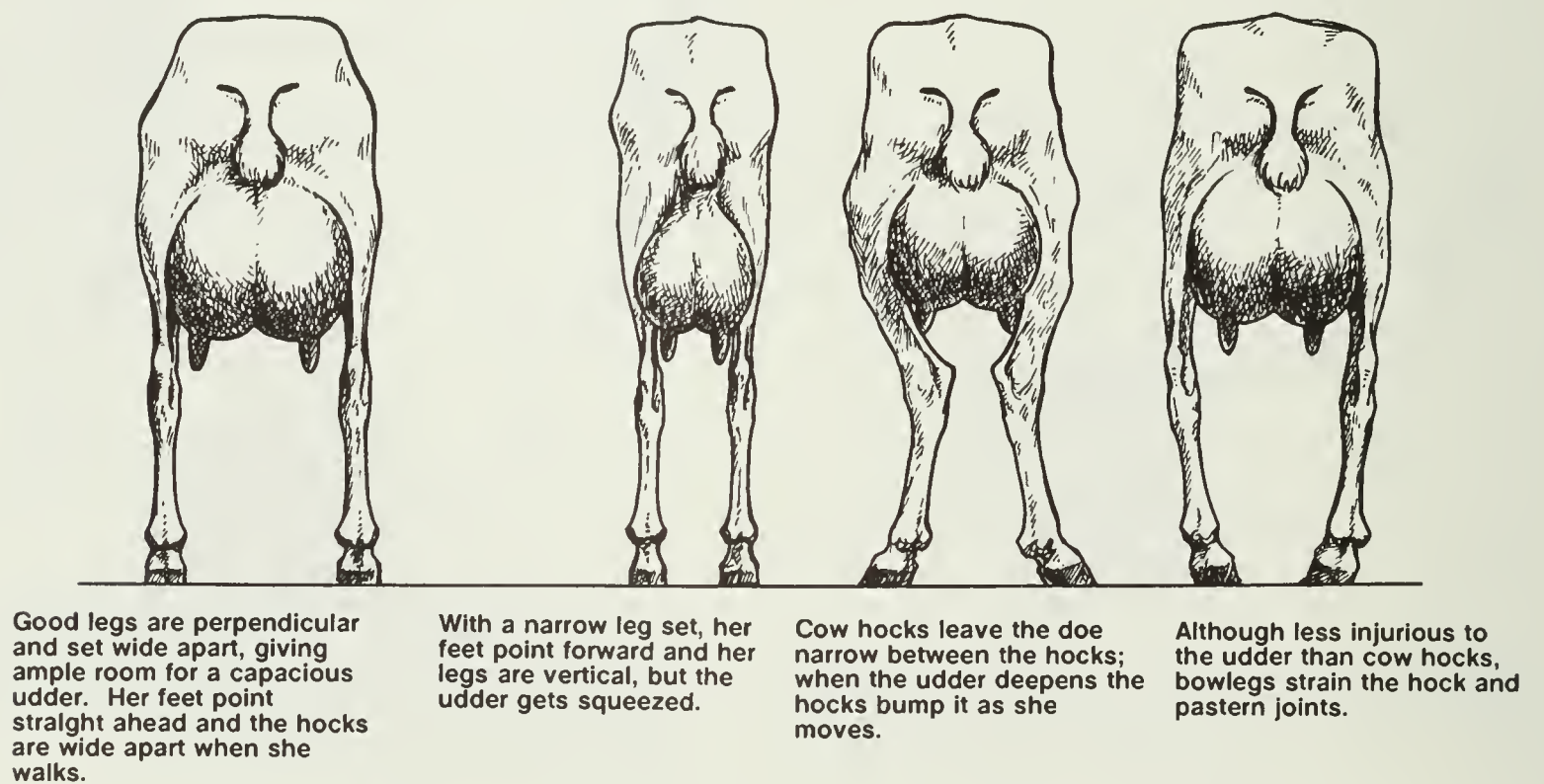
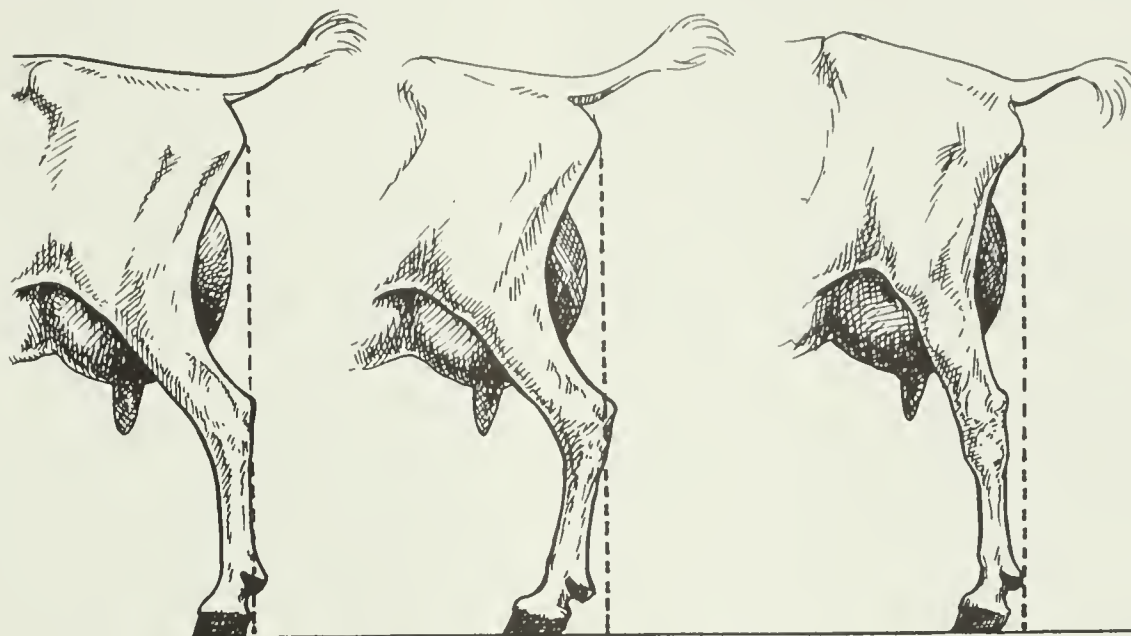


Figure 21 The set of the rear legs as seen from the side

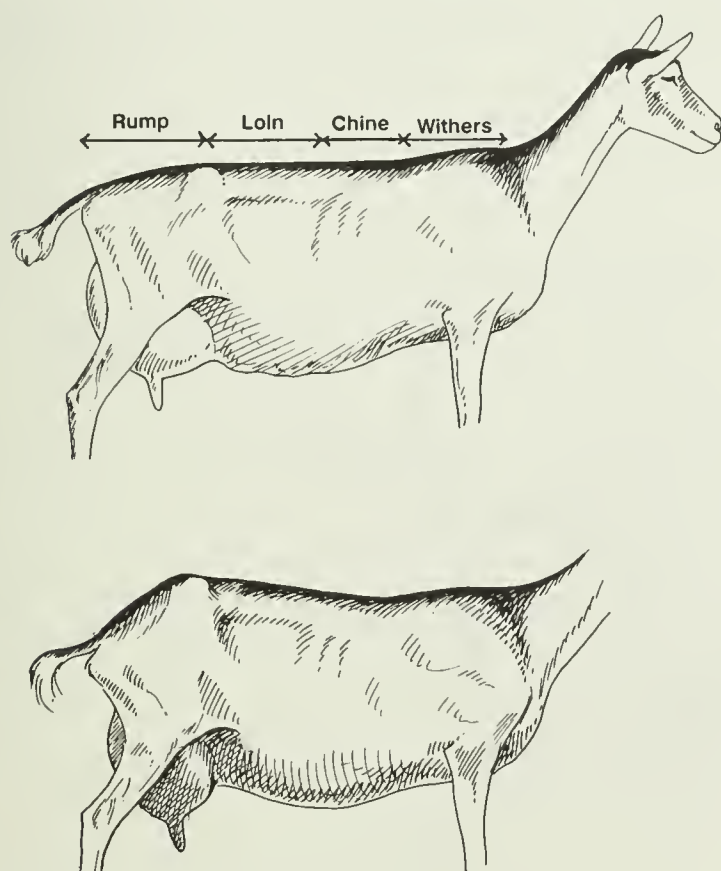


A vertical line from the pins should follow the rear leg to the ground.

“Sickle-hocked” legs can shorten a goat’s useful life.

A “posty” leg has no give in the stifle and hock joints, jarring the body with each step. Very painful, the condition often swells these joints and cripples the goat.

Figure 22 The topline is important. The upper illustration shows a good doe; the bottom one is too high in the hips, with too short and steep a rump.



TOPLINE This is also a factor in longevity; a strong back will support a capacious body heavy in kid, without stress on the doe. A broad, flat, nearly level rump provides width in the rear as well as internal support for the connective tissue supporting the udder.

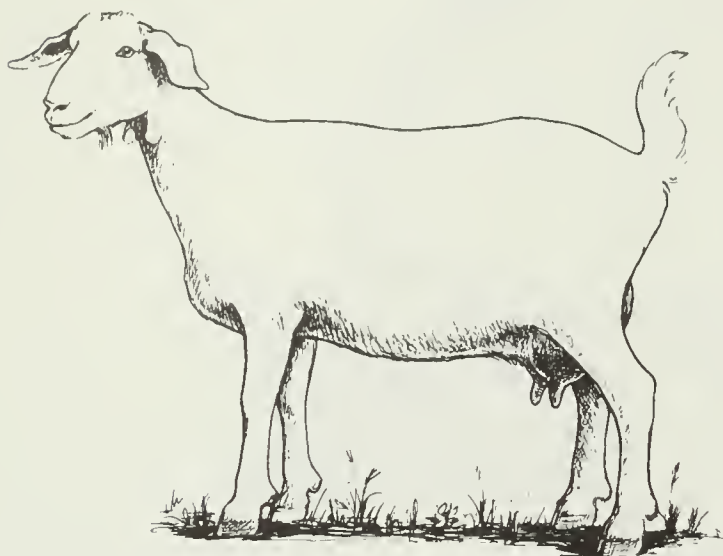
PUREBRED OR GRADE When faced with a choice between the two, given equally high-producing, healthy, well-formed animals, the higher initial cost of the purebred or Canadian of Breed may be offset by the higher value of her kids. Although grade buck kids only bring meat price, the large majority of Canadian and purebred buck kids are also sold for meat. Often the market for doe kids is also low enough that grades and even purebreds are assigned to the meat truck. However, the purebred kid has a greater possibility of being retained for breeding, or of bringing breeding stock price.

If kid sales are not a factor, the grade doe may have an advantage in vigor and longevity, although not in all cases. The value in a pedigree lies in the information it supplies about where a superior animal has come from and the possibility of reproducing that superiority. A name without more information (such as production or classification records) means little in itself.

BREED In a small herd, where facilities are limited, it is often best to concentrate on one breed. The selection of a breed is largely a matter of personal taste, though if you need higher butterfat content in the milk, the Nubian or the LaMancha may be the best choice. In

general, goats of the Swiss breeds give more milk. Remember, however, that good and poor individuals exist in all breeds. Also consider a breed that has a buck service available, since crossbred kids have a much-reduced market value in most areas.

Figure 23 Side view of a meat doe

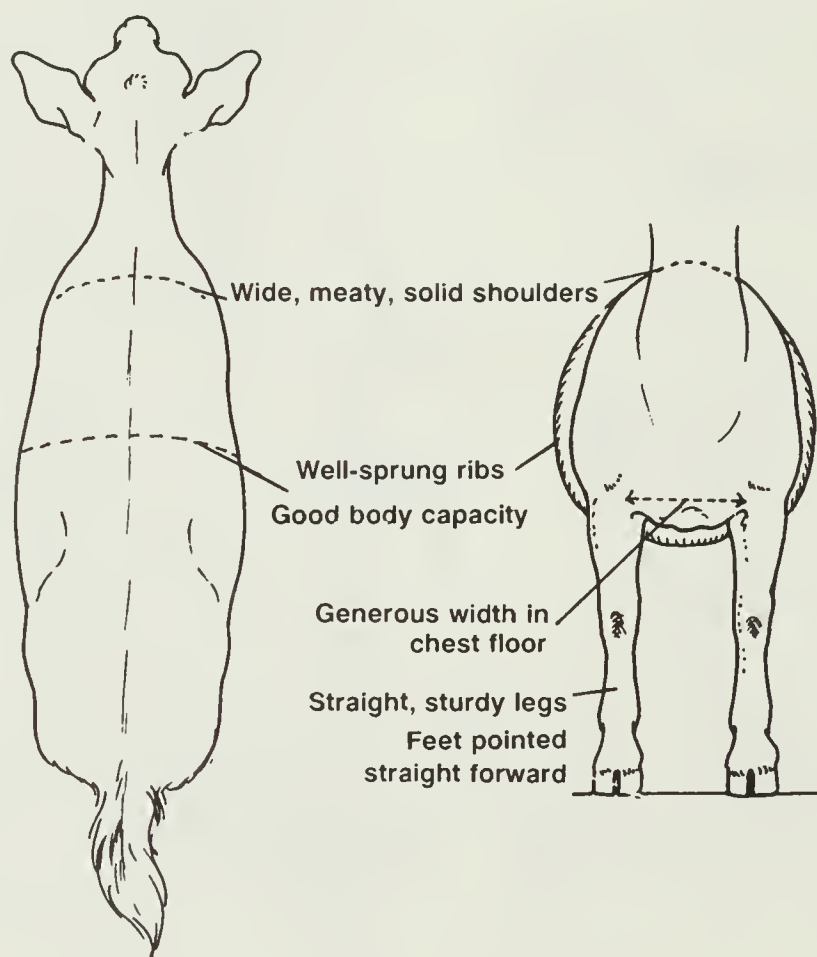


The doe used as breeding stock in a meat herd should have a rounded, meaty appearance. In early lactation, she may appear somewhat thinner, due to the demands of milk production, but she should put weight on easily at any other time.

Look for a relatively short, thick neck, plenty of width across the shoulders, breadth in the loin and a well-muscled rump. Check for an adequate layer of muscling over the ribs. Feet and legs must be sturdy and squarely set, preferably with bones that are almost rounded in cross-section. She should carry her udder high and well out of harm's way, especially if in a free-ranging herd. Heart and lung capacity are important for circulation and overall health, and generous capacity in the barrel lets the goat digest plenty of feed.

Often the 'unknown' breed of goat is the hardiest. In crossing two purebreds, however, another factor enters, that of 'hybrid vigor' – strength and vitality obtained by mixing two unrelated, inbred gene pools. In cattle, evidence exists that even more production is possible with the use of a third purebred sire on the second generation females, thus making use of the hybrid vigor of the dams as well as increasing the rate of growth and feed conversion of the offspring.

Figure 24 In a meat doe, look for these characteristics.



NUTRITION

The goat is a ruminant. This means that, in addition to the stomach that pigs, horses or humans have, the adult goat has a large 'fermentation vat', or rumen, as part of its digestive system.

In the rumen, coarse feed churns in a fluid mixture containing large numbers of microbes. These microbes break up cellulose fibers, producing starches and sugars that can be digested in the true stomach, or abomasum. In addition, the microbes themselves use the feed to multiply and thrive and, as their surplus population washes down the digestive tract with the rest of the feed, they supply additional protein to the goat. The microbes of the rumen also manufacture vitamins essential to the goat, so the health of the rumen microflora must be maintained. Sudden changes in feed, especially increased grain, can disastrously upset the balance of the rumen ecology and cause illness, even death, for the goat.

The goat enjoys a wide variety of tastes. On browse or pasture, it gathers feed by nibbling and nipping stems with its front teeth against the upper bony plate of its mouth, then swallows with little chewing. The food enters the rumen, where preliminary digestion takes place. When the goat has time and leisure to 'ruminate', it burps bits of feed up out of the rumen and grinds it further by chewing. This adds saliva to the feed, helping

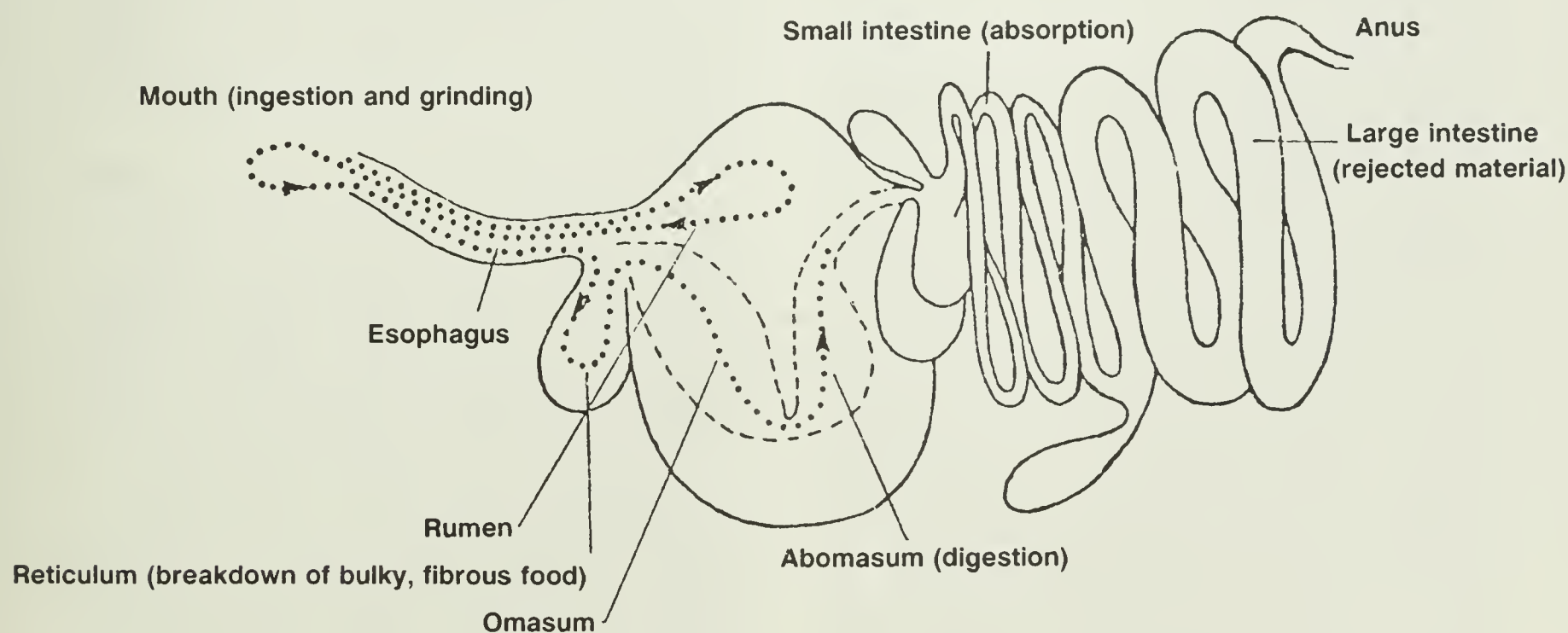
keep the rumen fluid from becoming too acid. When the feed has been reduced to the consistency of porridge, it sinks to the bottom of the rumen and moves through the reticulum and omasum (two more chambers of the forestomach) to the abomasum, or 'true stomach' and the small intestine, where actual digestion and absorption of nutrients take place.

A newborn kid has no functional forestomach, so it cannot digest coarse feed. Milk taken straight into the abomasum nourishes it until the rumen becomes large enough to support the animal. The rumen can develop quite rapidly if you encourage the kid to eat solid feed by presenting it with highly palatable hay and concentrates from about 3 days of age. As soon as it is eating enough dry matter, the kid can be weaned with little or no shock.

Like all animals, a goat needs water, energy, protein, vitamins and minerals. The animal's first requirement is to use its feed to maintain essential body functions such as respiration, heart rate, eating, keeping warm, etc., and to replace body tissues that are constantly undergoing breakdown and repair. Only then can it spare nutrients for production (milk or growth) or reproduction.

In most cases, you must provide feed for production before the animal has energy left over for reproduction. If the amounts of some nutrients supplied are borderline, however, some does may reduce milk production and rebreed, while others may respond in the opposite way.

Figure 25 A ruminant's digestive system – the dotted line marks the path of the food from the mouth through the stomachs.



If an animal is to grow or produce, its diet must contain adequate quantities all nutrients. For instance, a doe may be capable of producing 6 kg of milk per day, but if she only receives enough protein, calcium, phosphorus, vitamin A and other nutrients to produce 3 kg, she will only produce 3 kg. If energy, protein, calcium, phosphorus and micronutrients are adequate but vitamin A is limited, she will only produce as much milk as the supply of vitamin A allows. This is called 'the principle of the first limiting nutrient' and is important to remember when formulating rations.

A properly nourished herd is generally more productive, healthy and trouble-free. An annual analysis of the feeds you will use over the next winter can avoid a great deal of grief and expense. It is often difficult to evaluate by eye such factors as protein or carotene content, and tables of average values may be meaningless in a particular case. The only way to know what you are actually feeding is through analysis.

An agricultural extension agent will be glad to show you how to sample your feed and interpret the analysis. In sampling, the secret is to take samples from as many different areas of the stack or bin as you can physically reach. This will give you a more complete overall picture of your feed situation.

With this knowledge, you can make informed decisions about supplementing energy, protein or minerals for your animals, and may find you save money on both your feed and veterinary bills.

Energy

Energy is the fuel that an animal burns to move, maintain its body functions, produce heat in winter and so on. Ruminants obtain energy primarily from the fiber, carbohydrate and fat in their ration.

Energy is usually the most limiting nutrient in a ration. A deficiency through underfeeding is common – the goat will slow or stop its growth (even lose weight), give less milk, fail to conceive and be more apt to die (often from lowered resistance to disease). Deficiencies of protein or other nutrients often complicate energy deficiencies.

The energy value of forage depends on species and maturity. As the plants mature, the fiber increases, the energy content decreases, and the goats eat less of it voluntarily. Legumes usually contain more energy than grasses when cut at similar stages, while straws have comparatively high fiber and low energy. Grains, however, contain concentrated energy so are valuable as energy sources or supplements.

The amount of energy in a particular feed may be expressed in several ways. Total digestible nutrients (TDN) are measured as a

percentage of the total dry matter of the feed, by weight. Digestible energy (DE) is measured in megacalories (Mcal), which are units of heat. Roughly, 1 kg TDN equals 4.41 Mcal DE.

Protein

Proteins are composed of nitrogen compounds known as amino acids. Muscle, skin, hair, hooves and many other tissues and fluids in the body contain protein.

The rumen microorganisms break most of the protein in the feed down into ammonia and carbon compounds, using the ammonia to synthesize their own body protein. The goat then obtains most of its protein by digesting the microorganisms. This process lets a ruminant make use of non-protein nitrogen sources, provided there is enough energy in the feed. Dry does, bucks and other animals on maintenance diets are able to use non-protein nitrogen nearly as efficiently as conventional good protein such as that in soybean meal.

Part of the protein passes through the animal's rumen without being degraded, and moves directly into the abomasum and small intestine. This portion is called bypass protein. Although many goats can meet their protein needs from the microbial protein produced in the rumen, those with greater needs may require bypass protein as well. These animals, such as rapidly growing young kids and superior milk-producing does, are less able to utilize non-protein nitrogen sources; the feed passes through the rumen too quickly for proper protein synthesis. The resulting incomplete compounds may stress the goats, depressing production or rate of growth.

The primary symptom of a protein deficiency is a depressed appetite. A lowered feed intake can cause an inadequate energy intake, so energy deficiencies often accompany protein deficiencies. Other symptoms may include reduced milk production, irregular or delayed heat, loss of weight or slow growth.

Early cut legume hay is a primary source of good protein in most Canadian herds; grass hay generally has much less protein. While the protein content of grain varies with type of grain and, for instance, soil conditions, grain by itself is not a major source of protein. Many producers use a commercial 32% dairy supplement, mixed with grain as directed, to improve the protein intake of their milking does and growing kids.

Remember that an animal, depending on its size, activity, rate of growth and/or level of production, needs a certain *weight* of protein each day, not a percentage! Know how much your animals are eating by weighing their feed every once in a while, and know the protein content of that feed through feed analysis.

Calcium and phosphorus

These two minerals are critical to the nutrition of all animals, and are required in especially high quantities by lactating dairy goats. Calcium and phosphorus act together in the formation of bones and teeth, the function of many of the soft tissues (including nerves) and the production of milk. Besides enough of each, you must ensure the animals get them in the proper ratio. Ideally, this ratio is 1.5 parts calcium to 1 part phosphorus, although goats can tolerate from 1.2:1 up to 3:1 fairly well. Too much of one may produce the symptoms of a deficiency of the other.

In the lactating dairy goat, a deficiency of either mineral will, if continued over several weeks, lead to a decline in milk production. If the deficiency is of short duration, the goat will draw on her body stores without affecting yield, but ultimately her production will drop.

In the growing goat, an imbalance of calcium and phosphorus will cause slow growth, unthrifty appearance and deformation of bones, especially in the legs. If a doe gets too much calcium during late pregnancy, she may develop milk fever shortly after freshening; her ability to absorb calcium from her feed will have been impaired, and you will have to administer calcium intravenously at once. If phosphorus is oversupplied to a buck, he may develop calculi that can block the excretion of urine.

Legume pasture and hay have superabundant calcium. The ratio of calcium to phosphorus in alfalfa, for instance, may be as high as 7:1. Grain contains relatively more phosphorus – 1:4 to 1:8 – and may be used to bring the calcium:phosphorus ratio back into line. When too much grain in the feed is undesirable, adjust the total diet by substituting grass hay for legumes, and/or feeding a mineral mix with a greater proportion of phosphorus.

Salt

Common salt, composed of sodium and chloride, is vital to living tissues. It is the one substance animals seek out when their bodies need it. For this reason, producers often supply salt to their animals with trace minerals or range minerals mixed in, to be sure that the animals consume enough of these.

If possible, give goats loose salt rather than a salt block, as they may not spend enough time licking a block to obtain their requirements. Even if no other minerals are added, use salt containing iodine and cobalt; the animals need both elements and the feed grown in most areas of Canada is deficient in these.

Supply salt at 0.5% of the total diet. When fed free-choice, goats may consume more, but suffer no apparent ill effects.

Trace minerals

Goats need many elements in minute quantities – measured, usually, in parts per million (ppm), or even in parts per billion (ppb). Unfortunately, the feed grown in some areas contains even less than the tiny amount required.

On the other hand, many of these elements can poison the goats if recommended levels are exceeded. You must know whether or not supplements of a particular mineral are necessary. Feed from some regions is known to be deficient in specific minerals, so producers can add appropriate amounts to salt, minerals or concentrates as a matter of course without fear of toxic effects. Other deficiencies may not even be suspected until problems appear in the animals. An analysis of your feed is often the most economical way to determine how much of these minerals your animals are consuming.

Table 1 gives a general guide to mineral requirements for goats. Note that, in many cases, the total diet of the goats should be taken into account – if you suspect a mineral deficiency in your herd, consult a nutritionist or your agricultural extension agent.

Vitamins

Vitamins are compounds needed for normal body processes. Goats synthesize many vitamins in their bodies, but can get others only through their feed.

A healthy goat has the full range of B vitamins it needs, with the possible exception of vitamin B₁₂, which may be undersupplied in cobalt-deficient diets. Conversely, a goat that has gone off feed or appears sick, or a kid being raised on milk with little or no solid feed, will benefit from additional B vitamins given by mouth or injection. The goat also synthesizes vitamin C, and rarely if ever needs supplementation.

Vitamin K is another vitamin manufactured by the goat, as well as being plentifully supplied by most feeds. This vitamin helps blood clot. However, in cases of dicoumarol poisoning (from spoiled sweet clover), a synthetic vitamin K must be administered to counteract the toxins.

Vitamin D is essential for the formation of strong bones; a lack causes rickets, in which the bones become soft and irregular, and may bend under the animal's weight. Kids born to vitamin D-deficient does may have this condition from birth. Fortunately, this vitamin is cheap and easy to supply. One hour a day of direct sunlight will prevent problems; sun-cured hay is another good source. If goats live in complete confinement or must eat hay that has been stored for

TABLE 1 SUGGESTED AMOUNTS OF MINERALS IN TOTAL RATION

Mineral	Minimum	Maximum	Comments
Magnesium	0.18%	–	Acute deficiencies arise on fast-growing lush pasture. Symptoms: staggering, convulsions and death. Prevention: feed hay before turning goats onto pasture. Treatment: intravenous magnesium salts.
Potassium	0.8%	–	Deficiencies rare in roughage-based diets, but occur occasionally in high-concentrate diets.
Sulfur	0.2%	0.32%	Shortages possible in ration with high percentage of non-protein nitrogen. Symptoms: poor performance, hair loss, excess saliva, watering eyes.
Iron	50 ppm	1000 ppm	Deficiency rarely occurs except in kids fed exclusively on milk.
Cobalt	0.1 ppm	10 ppm	Deficiency symptoms: loss of appetite, emaciation, weakness, anemia, lower production. Generally supplied in salt at 1-2 ppm.
Copper	10 ppm	80 ppm	Both requirements and tolerances much higher than with sheep. Deficiency may occur with oversupply of molybdenum. Symptoms: anemia, rough "bleached" coat, bone deformities, possible diarrhea or incoordination.
Manganese	40 ppm	1000 ppm	Deficiency symptoms: reluctance to walk, deformity of forelegs, reproductive inefficiency.
Zinc	40 ppm	500 ppm	Deficiency symptoms: listlessness, poor growth, skin problems (dermatitis, thick dry patches on skin, hair loss, lesions around hooves and eyes), reduced testicular growth, poor libido, male infertility.
Iodine	0.5 ppm	50 ppm	Deficiency symptoms: goiter and reproductive problems (late-term abortion, hairless fetus, weak kids). Toxicity symptoms: dry rough coat, watering eyes, reproductive problems.
Selenium	0.1 ppm	3 ppm	Deficiency symptoms: unthriftiness or poor growth and (severe cases) white muscle disease (see section on diseases). Toxicity symptoms: lameness, dullness, emaciation and (severe cases) poor appetite, impaired vision, staggering, paralysis, death.

several months, supplement their vitamin D with an additive to their concentrate or water, or by injection. Vitamin D is usually included in sufficient quantities with vitamin A preparations.

Vitamin E acts together with selenium to prevent white muscle disease. This vitamin may also help prevent reproductive problems encountered with selenium deficiency. However, dairy producers have found that feeding extra vitamin E to lactating cows and goats prevents an oxidized taste in the milk.

Vitamin A is one vitamin Canadian goatkeepers should be aware may be in short natural supply for a good portion of the year. Fresh green hay and forage are excellent sources and goats may store this vitamin in the liver for 6-8 weeks to prolong its availability. However, late-summer pastures contain considerably less than those of early summer, and hay stored for more than 4 months may have lost much of the

vitamin. For these reasons, and because of the milking doe's great need for vitamin A (3800 IU/L of milk), give her a supplement from September until she is once again on spring pasture.

Goats need vitamin A for many reasons. It is vital to the health and function of the skin and eyes and to the linings of respiratory, intestinal, reproductive and urinary tracts. By maintaining these tissues, and by aiding in the absorption of such minerals as zinc and selenium, it forms a first line of defense against infections. Deficiencies cause loss of appetite, poor growth and bone development in kids, lowered milk production in does, eye problems, dry skin, unthrifty appearance, multiple infections, birth of weak or abnormal offspring, coughing and nasal discharge.

Green, leafy forages provide vitamin A through their carotene content. This carotene eventually oxidizes in most hay, but dehydrated legumes, especially pelleted alfalfa, maintain good

levels. Synthetic vitamin A used in supplements and injections is satisfactory, but take care to keep supplies fresh and cool for maximum activity. If vitamin A is injected, the animal may be given a 2-month dose, as it will store the excess in the liver and release it as needed. Vitamin A is especially important to the pregnant doe and her fetus(es), so ensure she gets enough during the last month of pregnancy.

Water

While goats have a reputation as water-efficient animals that can survive and produce in deserts, the modern dairy goat needs a considerable quantity of clean, fresh water to grow and produce milk. Lactation, of course, increases the need; a good producer can drink many litres a day. She cannot make milk without water, but if the supply is not perfectly clean, she may refuse to drink enough. If the water has even a tiny amount of manure in it, and thirst forces her to drink it, she may pick up a parasite that will ultimately reduce her milk production still further.

Kids in particular are susceptible to parasites, so keep their water especially clean. Some breeders feel that dry stock, bucks and kids can get enough water in the winter by eating snow, and indeed the animals may survive, but they use much energy to melt and use snow in the rumen. The goats will probably not grow or gain as well as you would like.

FEEDS

HAY Alfalfa and clover hay are legumes high in protein and calcium. Both are ideal for growing kids and milking does being fed high levels of grain.

Timothy, brome and other grasses generally contain less protein and calcium than do legumes, but do supply adequate nutrition for basic maintenance of dry does and bucks.

Mixed hay is a combination of legumes and grasses grown together. It combines a good protein content with a somewhat lower ratio of calcium to phosphorus. It is useful as a high-quality forage for goats on limited grain.

GRAIN You can use corn, oats, barley or wheat, depending on availability and cost. Corn has the most energy and least protein. Wheat is highest in protein, but very heavy for its volume, and care must be taken not to overload the animals. By weight, oats and barley have similar protein and energy contents, but barley's more dense.

SUPPLEMENTS You may use canola meal, soybean meal, dehydrated alfalfa or a commercial 32% supplement. Canola meal has about

40% protein with a calcium-to-phosphorus ratio of about 1:2, while soybean meal varies from 45-50% protein with a 1:2 ratio. Dehydrated alfalfa has a minimum of 17% protein – it is a good source of vitamin A with a ratio of about 7:1. If you mix the 32% supplement with grain as recommended, it will give a good supply of vitamins A and D; the calcium to phosphorus ratio is 2:1.

You can buy the 32% supplement with or without urea. Urea is not recommended for fast-growing kids or high-producing goats, because they eat so much that urea toxicity becomes a possibility. Symptoms of toxicity include uneasiness, muscular incoordination, bloat, prostration and convulsions; the animal may die. If you must feed urea to your goats, introduce it gradually over 5-7 days and watch for adverse symptoms.

SILAGE AND HAYLAGE Although their moisture content creates freezing problems in winter, producers who use these feeds report high production. However, goats must develop a taste for silage, so you have to accustom them to it gradually.

Make certain that silage has been properly fermented and is not in any way contaminated – poor silage has been linked to the disease listeriosis.

ROOT CROPS Potatoes, parsnips, etc. are popular goat feeds where plentiful. They may be chopped at first, then later fed whole. The time and labor may not be justified unless cost is extremely low. Once used to these feeds, goats seem to thrive.

WHEAT BRAN This is often used in concentrate mixes to provide bulk and phosphorus.

BEET PULP This is used for its high energy and fiber content.

MOLASSES Use sparingly, as it may cause digestive disturbances and off-flavor milk. A maximum of 3% in the concentrate may help stick the mixture together.

FEEDING

Newborn kids

A kid born in your absence may be weak and chilled – it may not be able to suck, the doe may not accept it, or it may suffer a vitamin A deficiency or some other condition. A severely chilled kid can look dead but, if it responds to a straw stuck up its nostril to stimulate it, it may be saved.

You may have trouble getting the kid to suck. If it cannot do this on its own, you must feed it colostrum (the milk produced the first few days after birth) through a tube. Raise the kid's temperature by soaking it in a basin of warm

(39-40°C) water, wrap it in towels, and pass the tube down its throat (Figure 26). You can use any soft rubbery tube (0.75 cm outside diameter, 35-40 cm long), the best being the surgical tubing available from most pharmacies at reasonable cost. A large plastic syringe (about 100-200 cc) without the needle can be attached to one end as a funnel for the colostrum. Gently slide the tube down the esophagus, using up approximately 18-20 cm of its length. You should be able to feel it in the esophagus, which is behind the windpipe.

Figure 26 Using a stomach tube



Long before the kids arrive, decide whether you will be raising them on the doe or feeding them yourself on a pasteurized-milk or milk-replacer program.

On the doe

If you decide to let the kids nurse the doe, be sure her teats are clean and that the milk can flow easily. Sometimes a small plug in the teat orifice must be squeezed out before milk flow can start easily enough for a tiny kid to suck it out. Check to see that the kid is sucking well, and that the doe is accepting it quietly. Sometimes a first freshener isn't quite sure if she wants the newborn nursing at her tender teats; soothe and hold her until she realizes it isn't so bad. Often, if the doe has licked the kid, she is quite willing to accept it (she might as well do the cleanup of the kid, but don't let her get carried away and eat the afterbirth).

A highly palatable hay and starter could be made available to kids when they're 3 days old. Soybean meal is an excellent starter for baby kids.

Pasteurized-milk program

If you decide to raise the kids on a pasteurized-milk program, remove them before the doe has licked them. Ideally, you be on hand from the time the doe starts showing signs of kidding. If this is impossible, and you don't want the kids to have raw milk, tape the doe's teats to prevent nursing – adhesive tape works well.

Take the kids directly from the doe and place them in a covered cardboard box. They will be fine here for a few minutes until you see that the doe is comfortable. Give her a drink of warm water with her favorite additives – cider vinegar or a trace of molasses are popular – and see that her bedding is reasonably clean. If she hasn't finished kidding yet, there is no point changing it.

Now clean the kids – the easiest method is to bathe them in warm water, then towel them dry (or use a blow-dryer on 'medium' setting).

Be sure each kid receives at least 0.5 L of heat-treated colostrum within the first 24 hours. Try to obtain some from a fellow-breeder before kidding so you'll have it on hand and store it frozen in small packages (100-200 mL). Thaw and warm one package for each kid (in warm water, not hot) while the doe is in the later stages of freshening.

If you don't have colostrum on hand, you will have to heat-treat the doe's colostrum. This takes a full hour, so get it started as soon as possible; the sooner the kids get their colostrum, the better they can absorb the antibodies it contains. After 6 hours it will give them very little protection, but an hour is not too long to wait. You can use cow colostrum if caprine arthritis encephalitis (CAE) is a concern, since cows do not carry this virus.

Pasteurized milk may also be frozen in small packages so you have it handy; thaw and warm it in warm water as you did the colostrum. Each kid should receive milk 3-4 times a day, with the combined total up to 1.5 L a day until the animal is 5 days old. Milk replacer may be substituted for an increasing portion of the milk until it makes up the total. Use only a high-quality replacer such as ewe milk replacer.

HEAT TREATING COLOSTRUM Strain the thick, yellowish fluid into a clean dish. Bring the colostrum up to 56°C and hold at this temperature for 60 minutes (the long period protects the essential ingredients that help the kid fight off disease and infection).

PASTEURIZING MILK Pasteurization heats the milk to a temperature that kills viruses and bacteria. You can buy a home pasteurizer, or use a double boiler on the kitchen stove. After treatment, quickly cool the milk in a sterile container; remember that everything the treated milk touches (utensils, funnels, etc.) must be sterile to avoid recontamination. You have a choice of fast or slow pasteurization methods:

- *Fast method* Bring milk up to 74°C but only hold for 30 seconds.
- *Slow method* Bring milk up to 64°C and hold it at that temperature for 30 minutes.

BOTTLE FEEDING You can buy nursing bottles from livestock supply stores. These are usually square, hold about 1 L and have sturdy nipples, and racks are available. However, you may only need a lamb nipple attached to a well-cleaned pop bottle. Bottle feeding lets you measure the exact amount of milk-colostrum that the kid drinks, and you will develop a close bond with the kid.

However, it is not the fastest way to feed kids. Cleaning the bottles is labor intensive. As the kid gets older, it will bump and jerk at the bottle, occasionally hurting the person feeding it.

PAN FEEDING This method can also be used from the first feeding of colostrum. Have the milk-colostrum 1 or 2° warmer than the normal 39°C to encourage the kid to drink from the pan. Simply put the kid's muzzle into the milk for a second; it will usually catch on and begin to drink.

Kids find it easier to drink milk in this fashion and will, therefore, drink more milk-colostrum in a

shorter time. You can use small bowls until the kid is a few days old, then switch to larger feeding pans. Bowls and pans are much easier to clean and maintain than bottles. You don't need nipples and tubes so there is less expense. If you feed the kids individually, you can still measure the amount they drink. However, if you do not have a keyhole feeder (Figure 4), the kids can get their feet into the milk.

LAMB BAR This consists of a large vessel with several hoses that have nipples attached. Such systems are available as complete kits, and feed several kids at once. However, you can't measure each kid's milk intake accurately. Cleaning is also time-consuming, and parts are fairly expensive, even if you build your own.

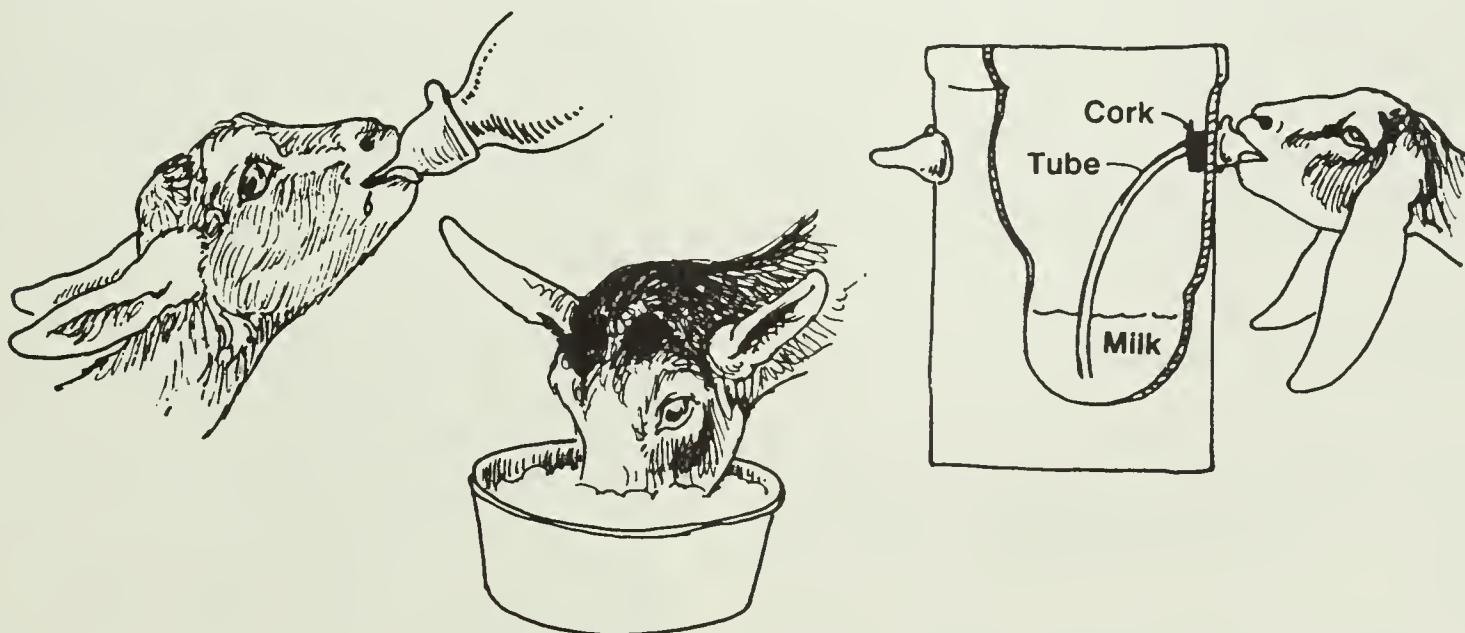
Replacement kids

Feed the kids twice daily. Some breeders feel that milk or milk replacer should be limited to 1.8 L per day.

Keep excellent hay in front of the kids at all times. Once they are well started on concentrate, let them have continuous access to 18-20% protein starter creep feed that has adequate vitamins and minerals. Continue this diet until they reach about 15 kg body weight, then start switching concentrate to 15% grower ration. As the kids approach 20-25 kg, limit concentrate feeding; do not let replacement doelings put on excess fat.

Although a kid may be weaned when its birth weight has tripled, this process is often delayed until it reaches 3 months of age or more.

Figure 27 Feeding (left to right) with a bottle, pan and lamb bar



Meat kids

Meat kids gain fastest on milk or milk replacer, fed free-choice. This may be given warm or cold; adding 1 mL formalin (37% formaldehyde) per litre may prevent abomasal bloat. Give the kids continuous access to good hay and 18-20% starter creep feed, until they reach 15 kg body weight, then switch to 15% grower concentrate.

Milking does

Three or 4 weeks before she freshens, start feeding the doe small amounts (100-200 g) of the concentrate she will receive as a milker. Gradually increase the amount until she is receiving about 1 kg/day, preferably in two feedings, by the time she is ready to kid.

At freshening, again increase the amount of concentrate as quickly as possible. Be careful that this does not cause digestive upset; feeding it to her more often, in smaller portions, helps avoid excessive acidity in the rumen. If you can't feed her at least three times a day, consider adding baking soda (available for livestock at low cost) to the concentrate, to prevent acidosis.

If the doe goes off feed, cut way back on the grain and be more conservative about increasing the amount fed. The idea is to feed her for a rapid rise in production. When she is eating enough concentrate to make up 60-70% of her total dry matter intake, and her milk production levels off then starts to drop, you may reduce the amount of concentrate to that needed for daily production – with grain-based concentrate rations, a rule of thumb is to feed 0.5 kg of grain for 1 L of milk.

Maintain good hay consumption by feeding the doe the most palatable legume hay you can obtain. She needs forage both for good butterfat levels in her milk and the health of her rumen. To keep her interested in this diet, occasionally switch to high-quality mixed hay, or alternate types of hay.

A high-producing doe may lose condition in the first few months of her lactation, and put on body weight towards the end. This is perfectly normal, even desirable, but don't let her become too fat.

Pregnant dry does

Two months before you expect her to freshen, dry off the doe (reduce her milk flow until it stops). If possible, separate dry does from milkers, since their feed requirements are very different.

It's a good idea to test the doe for mastitis before you dry her off.

To dry her off, reduce her production by withholding grain and succulent feed; give her a drier, poorer hay, and cut her water intake drastically (but not entirely). When she's producing less than 2.25 kg milk a day, stop milking her. Keep her isolated from the sights and sounds of milking that stimulate milk let-down.

Four to 7 days later, hand-strip out any coagulated milk in her udder. Do not milk her again.

During lactation, the doe will have eaten large quantities of grain, which can cause some irritation of the rumen lining. Also, the rumen will have shrunk since concentrated feed occupies less volume than forage. As soon as she is dried off, stop feeding her grain. She will be hungry, and will eventually turn to eating hay to satisfy her appetite; being hungry all the time will cause the doe to pack large volumes of hay into her rumen, stretching and conditioning it, thus getting it into shape for the next lactation.

If free from mold, reasonably green and not dusty, a coarse or low-protein hay is perfectly acceptable. A grass hay with 9-11% protein (dry matter basis) is ideal. During the fourth month of pregnancy, the doe can easily satisfy her own and the kids' requirements with hay alone.

In the fifth month, however, add grain to her diet in increasing amounts. At this time, the kids take up more space in her body and limit her rumen capacity, as well as making nutritional demands. Keep an eye on the doe to ensure she becomes neither too fat nor too thin. If you must adjust the amount of grain fed, you can cut down abruptly without problem (apart from the doe's complaining), but you can only add grain gradually to avoid serious problems.

Do not feed legume hay to a doe in late pregnancy. Legumes are high in calcium; too much in the feed will keep her from drawing on her body stores at the time of freshening, when milk production makes sudden large demands. Following freshening, the doe can be switched to high-calcium legume hay; she will adjust to absorbing her calcium requirements from her feed. On the other hand, a negative calcium balance for the first few weeks will not inhibit production or harm the doe.

Bucks

Buck kids can be fed more milk, for a longer period, than replacement doe kids. A little over-conditioning is not as serious with a buck, as he will never have to produce milk from an udder that has received extra fat tissue in its youth.

For most of the year, you can keep a full-grown buck on a maintenance ration. Grass or mixed hay is best, with only enough grain for energy, depending on his activity, the weather or the quality of hay. He can get his vitamins and

minerals from the salt-mineral mix, fed free-choice. If you supply fresh minerals weekly, the vitamins may be adequate, but otherwise the buck may need injections of vitamins A, D and E during winter.

A month before you need the buck for breeding, start giving him some grain. Raise the grain portion of his ration gradually to 1 kg/day, watching out for symptoms of digestive upset. He should come running when he sees the grain bucket; the more feedings per day you can divide his grain ration into, the more smoothly he will make the transition. By the time you need his services, he should have gained a good layer of subcutaneous fat. During breeding season, he will lose this, so you may have to continue the grain feeding for a while afterwards to get him back into shape. Remember, a buck that is too fat may not breed properly.

BREEDING

The goat has 60 pairs of chromosomes in each cell of its body; 30 of these were inherited from its sire and 30 from its dam. Each chromosome holds a certain number of genes – the nature and position of each gene controls a single genetic characteristic. During formation of the ovum or sperm cell, all this genetic material is shuffled up and divided in two. This gives each germ cell 30 chromosomes, each with its required number of genes, but in a combination random from the original pair. This makes genetics incredibly complicated, and we cannot predict the goat's characteristics with total confidence.

Some animal characteristics are governed by a single pair of genes, one from the sire and one from the dam. Often one is dominant and prevents the other (the recessive) from expressing itself.

One particular pair of genes, for instance, controls the presence or absence of horns. The gene that causes hornless (or polled) goats is dominant, so we use capital 'P' to describe it; lower-case 'p' describes the gene for horns. Genetically, therefore, any goat with horns must be pp (two recessive genes). If a goat is polled, its genetic makeup may be either Pp (with the dominant gene taking over) or PP. A horned (pp) goat will produce two germ cells and both will carry the gene p. The PP goat will produce two P germ cells; the Pp goat, however, will produce one of each.

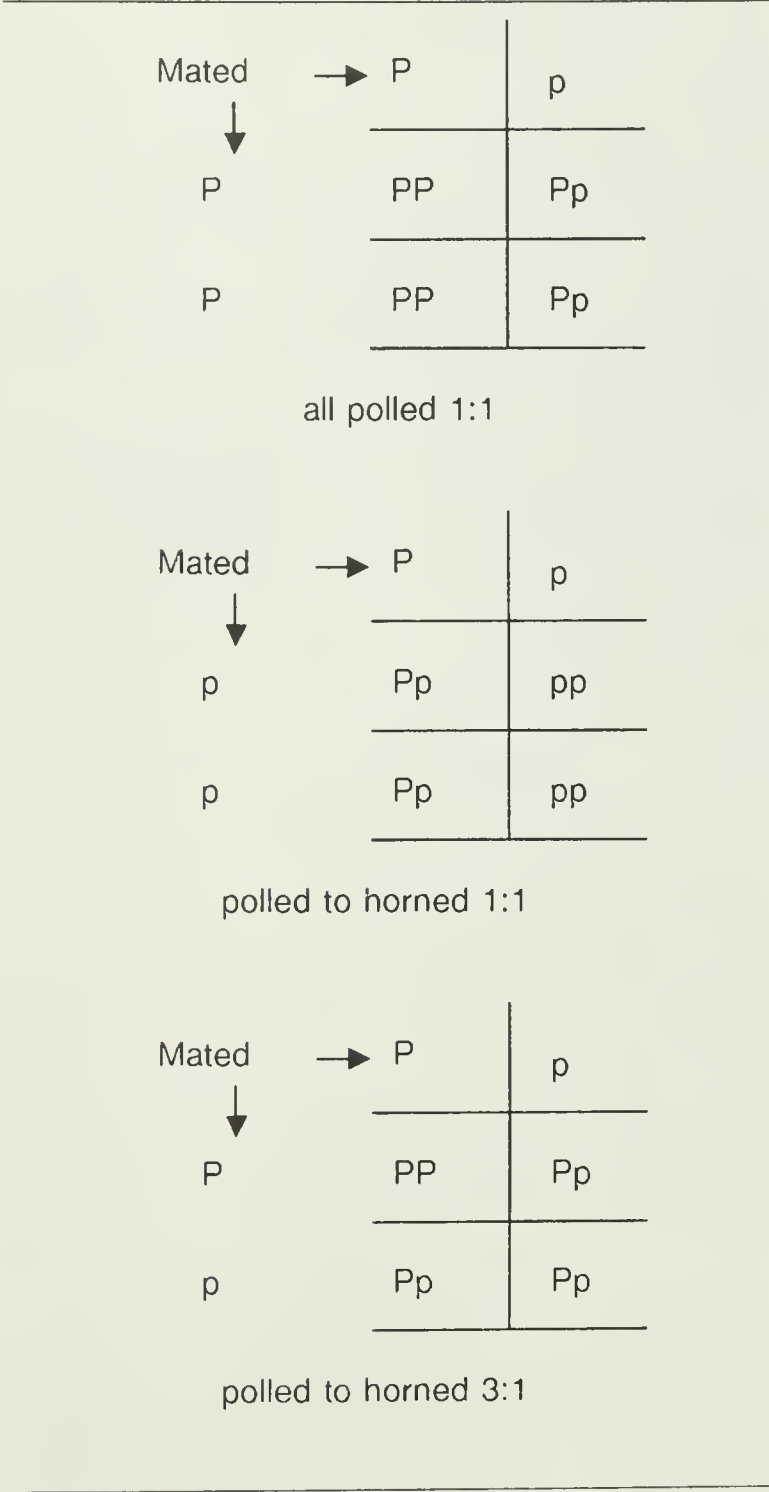
Mating PP with pp goats will produce only one genetic type of offspring, the Pp, since one gene must come from each parent. The animal will be polled. Mating a Pp with a PP, pp, or Pp will produce more variety of offspring.

This seems simple enough, but many of the characteristics we breed for in our dairy goats are

governed by dozens, perhaps hundreds, of pairs of genes. We are tempted to wish they were all as simple as the factor for hornlessness.

Unfortunately, another fact complicates even this simple example – hornless goats bred to hornless goats produce many hermaphrodite offspring. The PP gene results in a kid that is neither male nor female, but somewhere in between. It may look externally like one or the other, but will be sterile. Normal-looking female genitalia will often change and migrate during the kid's development, with the external opening of the urinary duct migrating downward between the legs, pointing backwards so that the kid is usually wet and messy on the rear legs. A scrotal-type mass may develop. It is important to remember that it is the female kid that develops into this useless freak.

Figure 28 P:p mating chart



Some breeders contend that the tendency to hermaphroditism is not present in all hornless lines and, of course, the Pp female is unaffected. However, thorough research has not found any exceptions. You take your chances when you concentrate on breeding for hornlessness.

You may be feeling discouraged, yet look at the dairy goats selective breeding has given us. The animal has changed dramatically from the original wild type to a large, capacious and productive animal that our ancestors would scarcely recognize. This has largely been accomplished by identifying the desirable characteristics and selecting breeding animals that most closely resemble the ideal. We can still use the same methods with equal validity, but with this advantage: we can identify and measure more accurately than ever before, using the computerized milk-testing program and nationally standardized type-classification program developed by the Canadian Goat Society.

Selection for improvement

Whether you keep a few goats for family milk, raise or breed show animals or operate a commercial dairy, the dairy goat's function is to give milk. A well-bred doe can produce goodly quantities of milk, persistently throughout her lactation, and for many lactations. Further, a truly desirable animal can pass these qualities on to her offspring.

Exactly how much milk the doe gives and how many lactations she has depends on the breeder's standards. Her milk production can be measured easily enough, by weighing her 24-hour production once a month and using this to calculate the total.

Unless a buck has many milking daughters, however, it is more difficult to determine his ability to influence milk production in the next generation. Even where several daughters are available for study, environment may influence production more than genetics. Ideally, to evaluate a buck, you need information from several lactations of several dozen daughters and their herdmates, in several different herds.

Lacking this information, you may select a buck from his pedigree. The buck who comes from a high-producing dam bred to a buck from a high-producing dam (and possibly having production-tested daughters as well) gives you a better chance to get improved dairy stock than does the buck with no accurate information about his ancestors.

You must also consider conformation traits, as they may relate to the longevity of a buck's daughters. Here again, it is wise to look at the conformation of daughters if possible, or at least at that of close relatives. Management plays a large part in a buck's development and, while one poorly cared for may sire daughters more correct than he is, some very good-looking bucks may not have the genetic strength to overcome structural defects in the does they breed with.

If a buck is to do your herd any good, he may be an expensive investment. But if you base your selection on the fullest information available, he may indeed prove worth 'half-the-herd' value.

The qualities you look for in a buck will vary with the doe you wish bred, and what you wish to breed for. If you are breeding dairy goats, however, at least part of your emphasis must be on milk.

TABLE 2 HERITABLE TRAITS OF DAIRY GOATS

Trait	Heritability	Measurement	Effect
Mature size	High	Tape & scales	Breeding stock sales
Percent fat	High	Milk-O-Scan	Milk price differential
Percent protein	High	Milk-O-Scan	Cheese yield
Milk production	Medium	Milk scales, test program	Milk sales
Milking ease	Medium	Milk flow (kg/min)	Time & labor costs
Mastitis resistance	Medium	CMT, somatic cell count	Lifetime yield, labor and treatment costs
Conformation	Medium	Classification, observation	Breeding stock sales
Longevity	Low	Age at culling	Replacement rate
Reproduction	Low	Kidding interval	Milk yield/year
Udder edema	Low	Observation	Production, labor and treatment costs
Feet and legs	Low	Observation, classification	Replacement rate

You will make the greatest progress in your breeding program by selecting for a single characteristic at a time. Having reached that goal, you may switch your emphasis to another trait you wish to improve. Some traits are more easily changed than others, and are spoken of as having high heritability. This may be because they are governed by fewer pairs of genes, or because environment has less influence on their expression, or because accurate measurement is easier. It is difficult to assess improvement if measurement is totally subjective and varies with each person.

You may find that certain traits have more value to you than others. In that case, try to improve the most economically important ones first.

Age at first breeding

A doe may start coming into fertile estrus, or heat, as early as her fourth month, but don't let her breed until she has attained at least 32 kg body weight; many breeders feel that 40 kg allows even better development. Depending to some extent on genetic factors, but to a larger extent on management and feeding, she may attain either weight by the time she is 7-9 months old. Bred at this time, she would freshen when 12-14 months old. A milking yearling will earn her keep, if milk has value on the farm. If she continues to grow during lactation, her milk production may be low but steady.

A number of breeders prefer to let their doelings stay open (not pregnant) and grow well past their first birthday; some may be kept for 18 months before being bred. The first-freshening 2-year-old does not milk as heavily as the second-freshening 2-year-old, but it has not been proved (as some claim) that it has a longer productive life. Certainly such a doe may classify one or two points higher; on the negative side, a dry yearling is often difficult to get in kid as she has a tendency to get fat. You must decide where your emphasis lies.

Breeding season

In Canada, goats are highly seasonal in their breeding. Light governs the fertile estrous cycles, which generally begin 10 weeks after the longest day of the year. In early September until late February or March, the greatest number of does will be fertile during their heat period. By the middle of April, most have ceased cycling and will take no interest in breeding until the following September. A small number, perhaps 5%, will cycle 1-2 months earlier or later than their herd-mates. Good nutrition and management will allow individuals to express this tendency; the trait may also be genetic, allowing long-season breeding by selecting dams from kids born from September to December, without special treatments.

Treatments exist to bring about fertile estrus in a doe that has ceased cycling because of this yearly anestrus (or non-breeding) season.

Signs of heat

You have to recognize signs of heat in your breeding stock. Early or very late in the breeding season these signs may be very subtle. From October until February, however, the mating urge is stronger, and the unbred doe often becomes very obvious during her estrus. The length of the estrous cycle (from day 1 of one heat to day 1 of the next) may vary from 18-24 days among individuals; the length of estrus itself may vary from being apparent for only 12 hours to being unmistakable for 4 days. Midseason heats (October-December) tend to be strongest, and breeding during this period may result in more multiple pregnancies. Look for the following signs in a doe:

- Her vulva (genital opening) becomes somewhat swollen, moist-looking and, usually, pink to red.
- She exhibits unusually restless behavior and bleats often.
- She is highly attracted to the scent of the buck. You can prepare a 'buck rag' by rubbing an old nylon stocking over a buck's scent glands on the head behind the horn area. Store it in a glass jar with tight-fitting lid. When the doe is given a whiff of the jar contents, she will intensify in displaying estrus, if in heat.
- She wags her tail restlessly and relentlessly from side to side.
- The mucous discharge from her vagina varies in quantity, but is usually thick and opaque in early estrus, thin and clear during standing heat, and turns opaque and white again at the end of standing heat.

Typically, a doe entering estrus may start pestering other does (often only one) in the herd, trying to induce chase-and-mount behavior. During standing heat, she will remain quiet until mounted by a herd-mate or buck. As she goes out of heat, fighting and chasing again take precedence.

Some symptoms will be more apparent in some does than in others; you must observe your own animals closely for variations in behavior.

Selecting a buck

The important word here is 'selecting'. Just about any buck is fertile, especially if he's the wrong choice. The buck kid nursing his dam or penned up with the doe kids until late summer, or the meat buck you were saving for the people who didn't want him castrated – these fellows

inevitably seem able to get a doe pregnant. One great aid to a supervised breeding program is a good, escape-proof buck fence, with the bucks on one side and the does someplace else. A buck pen may hold one or several bucks quite happily until breeding season begins; once the does actually start coming in heat, your well-behaved buck can turn into Harry Houdini. Check out the pen before temptation arises – mend any broken boards or put on another rail if you feel it might be a good idea. If a buck does escape, find out how many does he may have bred.

CARE OF THE BUCK In many herds, the buck is used only 3 or 4 months of the year. The rest of the time he is kept on a maintenance diet, and hardly looked at except for a possible one or two spring shows. When breeding season starts, however, you need his services immediately. A buck should enter breeding season with an extra layer of condition – a good glossy coat and enough fat to smooth out the corners. Too much fat, on the other hand, will slow him down, prevent the proper action of hormones and may, in fact, cause sterility. From September to December, he will usually be too excited to eat and will lose weight dramatically whether used or not.

To make sure he will be in good shape and eager to work, check him carefully 2 months before. If overfat, keep him on maintenance rations – high roughage – to make sure he doesn't gain more weight. If rather on the thin side, check for worms. Take a fecal sample to your veterinarian and have it checked for parasites and (if the buck is still quite young) coccidia; treat either problem as the veterinarian advises.

Start giving the buck extra energy in his diet, but don't change his ration too quickly or you may put him off feed. Gradually add more of such digestible feeds as leafier hay or concentrate ration; starting with 100 g/day of grain, you should take several weeks to increase this to 600 g/day.

Make sure the buck gets the necessary minerals and vitamins. In some areas, feed may be low in zinc. This mineral is very important to male reproductive processes; other mineral deficiencies may contribute to a lowered overall health. Supplement vitamin A if the buck is not on good pasture. To encourage consumption of the proper minerals, etc., combine his salt 50:50 with a good balanced mineral-vitamin mix. Replace the mixture weekly to be sure the vitamin content is maintained.

Check the buck for external parasites. Lice are usually at a low ebb during summer, but even a few can multiply quickly and cause some anemia. You can find a number of products to treat bucks not destined for slaughter.

Trim his feet and check them for soundness. Investigate any lameness, which could interfere with his spirit or his ability to mount. Don't let an arthritic buck gain too much weight.

Check his testicles; they should be firm and healthy. If you find any swelling or puffiness, or large or small hardened masses in the scrotum, refer to a veterinarian for diagnosis. Check the skin around the opening of the sheath to be sure there are no sores or 'pizzle-rot'; observe to see that erections and urination seem to be normal and cause no discomfort.

If you use the buck for out-of-season breeding from May to July, your veterinarian may recommend he receive hormone treatments up to a month before. If you are using light-treatment to extend the breeding season, be sure to treat him at the same time as the does (though preferably not in with them).

Light-treatment fools animals into thinking the breeding season has arrived. You keep the animals under fluorescent lights that you turn on progressively later each morning and off progressively earlier each evening. This simulates daylight during a seasonal change.

Some breeders start off with a doe treated to come into heat a week or so before the important does start cycling, to remind the buck what it's all about. Certainly it is frustrating to successfully bring the does into heat out of season, and find that the buck has little or no interest in them. Artificial insemination, once you get the hang of it, will neatly side-step this problem, as it works at any time of the year.

INFERTILITY IN THE BUCK To be fertile, a buck must produce sperm that can fertilize an ovum. He must also have the desire and ability to mount and mate with the doe. If he lacks these, even partially, it reduces his fertility.

Congenital or hereditary conditions may cause reproductive problems. Many defects of the testes or the penis are hereditary, and may be spotted by palpation and observation. Undersized testicles, absence of one testicle, deviated penis, etc., are examples. A recessive gene can cause some sperm defects that can interfere with fertilization.

Acquired sterility may result from injury, disease, nutrition, environment or handling. Even if fertile, the buck may be unable to mount because of disease, injury or hind legs that have swollen joints or sprains; painfully overgrown hooves may produce the same effect. Bruises or even fractures of the penis may result from overuse or interference during breeding, and may prevent erection (despite a strong desire) and adequate sperm fertility.

Insufficient nutrition delays puberty, depresses production and lowers semen quality. In a growing buck, it may cause permanent damage of the germinal epithelium of the testes. In a mature buck it lowers libido, but you can correct this by carefully increasing the energy content of his feed.

Vitamin A deficiency may lead to testicular degeneration, while iodine deficiency may affect libido and sperm quality. Copper, phosphorus, cobalt, zinc and manganese deficiencies can also cause fertility problems.

If hot weather or disease elevates the buck's body temperature by even a degree or so, his fertility may be impaired. Disease, especially with fever, can cause at least temporary sterility. The high body temperature alone can affect fertility for up to 10 weeks; if bacteria invade the reproductive gland, swelling may be followed by degeneration, calcification or atrophy of one or both testicles. The infection usually affects the tubules, blocking them and preventing normal function; it can be diagnosed by the presence of pus in the semen if examination is conducted in the early stages.

Heat stress commonly causes temporary sterility; house the buck in cool, well-ventilated quarters and allow him plenty of fresh, clean water during hot summer days.

A mature buck can handle a large number of does over several months. One buck to 50 does is not unreasonable, if breedings are spaced. A young buck, however, must be allowed several days to a week between breedings. Be strict about his breeding activity; don't allow more than one service in 4-6 hours, and only two per breeding. Otherwise you may find that the young fellow who settled two or three does early in the season may not be fertile for another 2 or 3 months. Of course, don't let him run with does in heat, for the same reasons.

Hand breeding versus pen breeding

In hand breeding, you identify individual does in heat, take them to a particular buck and supervise their breeding. This gives the most accurate breeding records. However, if faulty heat detection lets the doe be bred when not in standing heat, or fails to indicate when she returns to heat, it can be an inefficient method. If you cannot check your does two to three times a day other than at feeding and milking, you may miss those in heat – especially early in the breeding season.

Commercial milk producers who must have their does freshen as early in the fall as possible may choose a pen-breeding system for doelings. They avoid pen breeding for milking does because secretions from the buck's oily scent gland may get transferred by the does' hair, or even the atmosphere, into the milk. Previously unbred doelings, however, may be divided into breeding groups that each share a pen with a breeding buck. If the buck wears a marking harness, you can record each doe's breeding date by observing which day she has been mounted. Remember, however, that a vigorous buck may mount a

cornered doe whether she is in heat or not, especially during his first few days in the pen. Change the color of the marker after the first week to catch any does that come back into heat. Since the buck is your most accurate heat detector, pen breeding is the most certain way to make sure the does conceive.

When she has had minimal previous contact with a buck, sudden exposure to one will often bring a doe into fertile heat within 5 days. This is the well-documented 'buck effect', which has even happened early in the breeding season before heats become noticeable. You may find it worth a try, if you are trying to encourage your does to cycle earlier. Be sure they have not had any contact with a buck, or even with the scent of one, for a couple of months previously, and you will have better success.

Artificial insemination

Canadian breeders have used frozen semen for many years to inseminate does without a buck. When a buck's drawbacks are considered – his odor, his unmanageable behavior, and his care and keeping – artificial insemination (AI) becomes quite attractive.

The semen available in Canada, even if imported, has been collected under conditions of excellent hygiene from certified healthy bucks. You can make genetic improvements in your herd most rapidly through AI, when the semen comes from genetically superior sires. The Canadian Goat Society is now developing a 'sire-proofing' program to evaluate the ability of a given sire to improve milk production and type in his daughters. The AI sires offered for use at present all show promise in pedigree and type, and you may wish to use one or more to introduce a greater range of genetic material into your herd.

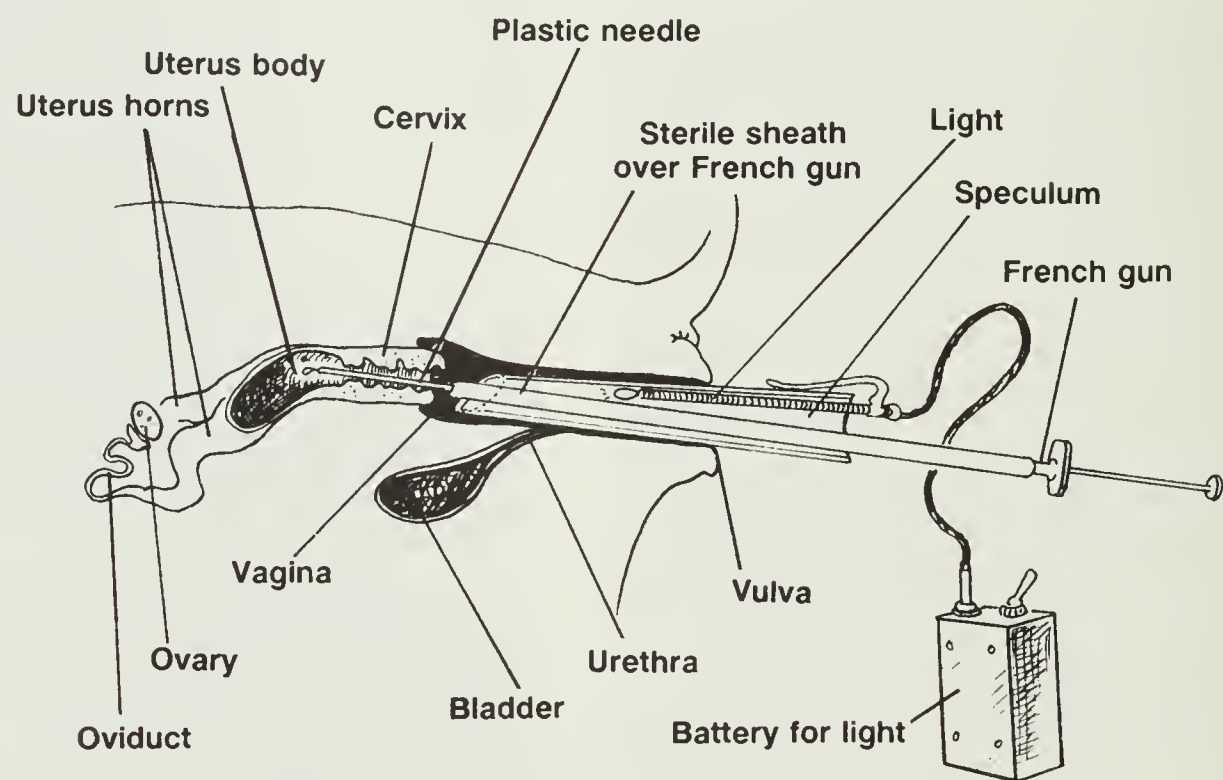
In natural breeding, the buck deposits his semen at the entrance to the cervix but the volume and numbers of sperm cells are vastly greater than in AI. The doe herself also responds somewhat better to natural breeding, in transporting sperm into the uterus, for instance. To inseminate a goat, you should try to deposit the semen within the body of the uterus, or at least inside the cervix. This overcomes natural breeding's advantage to a great degree, if not completely.

In some parts of the country, provincial departments of agriculture may sponsor or help arrange hands-on courses in the technique of artificial insemination for goats, if enough producers express an interest. You must use special insemination equipment for goats, but frozen semen can be handled in exactly the same way as bull semen, and is often shipped and stored through the same distribution system the cattle breeders use.

Figure 29 Artificial insemination



Figure 30 Artificial insemination equipment inserted into the reproductive tract



Pregnancy testing

A doe bred while in natural heat during the regular breeding season permits the cheapest and one of the most reliable indications of pregnancy – she doesn't return to estrus 3 weeks later. However, if she misses one heat cycle but returns to heat some time later, she may have reabsorbed the embryo for some reason.

Does should be gaining weight at the time of breeding, and should be kept on this high plane of nutrition until pregnancy is well established, in the third or fourth week after breeding. Called 'flushing', this lets more ova be produced and become fertilized; the doe is less likely to lose the entire pregnancy. If she does return to heat, you may try to breed her once more before suspecting disease. If she still does not catch, check with your vet.

Other methods of pregnancy detection have been marketed in the last few years. One kit tests milk for the level of progesterone. The test must be performed at the time the doe would be expected to return to heat if still open (18-22 days after breeding, depending on the individual animal). Most does could be tested at 20 days with good accuracy. A high level of progesterone indicates possible pregnancy.

Another test checks for a pregnancy hormone, oestrone sulfate, in milk or urine. You can send samples to one laboratory, or buy a kit from another laboratory for testing at home. This test may be tried as early as 35 days after breeding, but is more accurate after 50 days.

Machines exist that employ sound and ultrasound to detect pregnancy, but are very expensive and an operator needs some training to operate them effectively. They are most useful to commercial milk producers, who must check the pregnancy rate on out-of-season breeding to predict their winter milk supply. Occasionally, the breeder with a few animals may induce the owner of one of these machines to lend or rent services.

There are other ways to check a doe for pregnancy. Some, like a rod that probes the doe internally through the rectum, can cause enough stress to abort the fetus. Some breeders have the knack of palpating the doe's abdomen to discover if the uterus is enlarged and solid. But the surest and least dangerous method is to wait 5 months and see if kids are born. Certain signs may become evident before this time, of course. First fresheners, in particular, will start to show udder development in the fourth month, and even an older doe's dry udder will start to feel 'alive' in the fifth month. Abdominal expansion is most evident in the depth of the barrel at the flank, even if there is little apparent gain in width.

Fetal development

The gestation period of the dairy goat averages about 145-155 days, but a few days more or less usually won't harm the doe or kids.

Toward the end of standing heat, the egg (or ovum) is released from the ovary and moves into the oviduct. Fertilization takes place here, and the fertilized ovum then continues on toward the uterus, developing along the way. By the time it reaches the uterus, this has undergone certain changes as well, which allow the embryo to attach itself to the uterine wall and continue developing. Goats commonly release and fertilize more than one ovum. Each implants at a different site in the uterus and develops its own placenta. The placenta is part of the fetus, and is the organ through which it gets nutrients from the mother's blood. To some extent, the placenta also diffuses hormones into the mother, to maintain pregnancy, initiate birth and provoke development of milk-producing tissue in the udder.

By the time the fetus is 60 days old, it has almost fully formed, except for a few details such as teeth and hair. From this point, it simply grows in size until birth. Although size increases rapidly, the fetus starts out so small that its growth only begins to make serious demands on the doe in the last 6 weeks of pregnancy. Multiple fetuses, of course, make more demands. In the last 2-3 weeks before birth, hair appears on the kid and teeth break through the gums. Horn development is variable, some kids being born with distinct little horns, others only developing horns 3 weeks after birth (of course, goats that are naturally polled will never grow horns).

After birth, the doe expels the placenta, sometimes called the 'afterbirth'.

Unwanted pregnancies

Prostaglandin injections can wipe out an unwanted pregnancy; the manufacturers claim there is little danger that the chemicals will confuse the animal's hormone system, but still be cautious in their use. Given any time from 6 days to 6 weeks after breeding, the injections cause the doe to abort with a minimum of suffering, but the earlier you use the chemical, the less she will notice it. Prostaglandin, however, also brings the doe back into heat 48-72 hours after injection, so be sure the buck is safely tucked away!

Seasonal and out-of-season breedings

Whether you sell the milk commercially or use it for your family, that produced in the winter is more valuable than that overproduced in the

spring and summer. Although you may have more time during the summer, you may find that consumption seems to soar in inverse proportion to the supply.

A doe bred in September will kid in February; one bred in March will kid in August. Even with two equally productive does, the one that freshens in August will produce somewhat less milk during her lactation than the one that's fresh in February. Neither has really been bred out of season, although some does will not start to cycle until late September and others will not cycle past early March.

It takes very little interference with the natural breeding season to maintain this schedule of freshening. However, if you have any doubt that the does are in heat in September – they may not return to heat, simply because breeding season is over – you may wish to breed one or two extra in March. The doe that doesn't catch in early September, though, makes the fact obvious by coming back into heat, and can be bred again with a short delay in freshening.

Light has been used to bring does into heat out of season. It 'fools' their pituitary glands, which control the onset of breeding season. The treatment either limits the hours of light the does are exposed to for 10 weeks, or adds hours of 'daylight-bright' light and then suddenly decreases those hours 10 weeks ahead of time. Some does will spontaneously start coming into heat regardless of the time of year. This system has the advantage of not adding chemicals to the goats' systems.

A recent development in out-of-season breeding is a sponge impregnated with a progesterone-like compound. Inserted like a tampon in the vagina, the chemical is slowly released and absorbed by the doe. In nature, does receive this 'priming' with progesterone at the beginning of breeding season, before a fertile estrus is possible. With the sponges, however, you may begin the process at any time. During deep anestrus (usually April to July), leave the sponge in for 11 days and treat the doe further with injections of estrogen (pregnant mare serum gonadotrophin, or PMSG), and possibly cloprostenol, 48 hours before it is removed. This ensures a fertile heat, which usually begins 18-36 hours later. During the transitional season (late March to early April or July to August), inject the PMSG and prostaglandin at the time of sponge removal on day 11.

These sponges may also be used to synchronize does during the breeding season. The sponge is used alone in that case, and heat occurs 24-48 hours after its removal. Prostaglandin may also be used in this way with does that have been cycling, to induce a fertile heat 24-72 hours after injection – it will not be effective, though, if used within 6 days of the doe's previous heat. Synchronization is valuable

if you have limited time for heat detection, or if you must take a doe out to be bred where she cannot be boarded. Don't use prostaglandin on a doe that may have been bred earlier or she will abort; the sponge treatment is somewhat safer in this case. Note also that many of these chemical treatments require that the doe's milk not be used for human consumption for some time.

Breeders that concentrate solely on freshening does for the show season may not be interested in maintaining a steady supply of milk. They may find it easiest to breed all the does at once to simplify kid-raising, even if it means buying a few quarts of milk in the winter. Parents of children allergic to cows' milk, however, do not always have that choice. Of course, milk may be frozen for later use, but never quite tastes the same as when fresh.

Problems with the doe

THE OVERFAT DOE This is often a dry yearling or a doe that has been dry for quite some time. If she has been receiving even a little too much energy in her feed, or has not exercised enough, she can accumulate fat over a long period. Goats do not normally carry much subcutaneous fat, so when you begin to see it, you can be sure the internal organs are heavily covered as well.

Most of the major reproductive hormones are fat-soluble. As they circulate through the system of a fat doe, her fat tissue absorbs them uselessly. Add to this the general reduced efficiency of circulation, and you will have trouble getting this doe bred. She may not appear to cycle at all, or may come into estrus every 5-7 days. Ovarian cysts are the most common result of obesity. You have to reduce the doe's weight before any treatment is likely to help; even were she to conceive, pregnancy would create further dangers to her health. Later, your veterinarian may prescribe gonadorelin hydrochloride injections.

THE THIN DOE A doe that puts out more energy than she takes in is unlikely to have enough energy for reproduction. Heavy lactation can cause this, but in some cases the doe is just not being fed enough. At the peak of lactation, when a high-producing dairy goat is about 60-90 days fresh, it is almost impossible for her to eat enough to maintain her body weight and milk like she wants to. In the following few months, she will start to keep pace with production and, if fed adequately, will begin to put on a little more weight. By the seventh month of lactation, when you want to breed her again, she should be gaining weight to increase the possibility of multiple ovulation.

While dry does can maintain themselves for most of the summer on browse and pasture alone, the milking doe needs hay plus additional energy from her grain ration throughout her lactation. If

she is on pasture or browse, she will probably eat less hay than in the winter and you must provide it or she may not be able to recover her optimum condition in time for breeding in the fall.

PYOMETRA AND OTHER INFECTIONS A long-standing metritis (infection of the uterus) will interfere with breeding. Often the infection walls itself off inside the uterus with heavy scar tissue, and the uterus fills with pus (pyometra). Metritis most commonly results from a difficult kidding, kidding in a dirty area, unhygienic assistance at kidding, etc. In any case, it will likely have happened shortly after the doe's previous freshening. Your veterinarian may undertake some treatment – systemic antibiotics, uterine infusions and even major surgery have been successful in some cases, but not in others. Get a good estimate of the cost of treatment, and decide how far you want to take it. Try to be realistic in your decision; not every goat is valuable enough to warrant extraordinary treatment, even if she is your old favorite and you feel this whole thing might be your fault. It may be easier on her to let her go. Just be sure it doesn't happen again.

OTHER PROBLEMS Phosphorus and copper deficiencies can suppress estrus or cause irregular estrous cycles, respectively; mineral deficiencies may do either. Manganese shortage will delay onset of estrus, and may impair fertility. Deficiencies of vitamins, especially vitamin A, can interfere with ovary function or fetal development.

Hot weather at breeding time may lead to abnormal ova, which may not implant properly in the uterus. Stress may also cause problems with implantation of the embryo, or (if severe enough) cause abortion.

Some pasture plants, such as ladino clover and trefoil, produce a compound very much like estrogen. This substance encourages the growth of cysts on the inner lining of the cervix or uterus and interferes with sperm transport, so the does cannot conceive.

KIDDING

Preventing problems

Dry off the pregnant doe at least 6-8 weeks before she kids. During the last part of her pregnancy, the kids grow very fast and take up most of the room in her abdomen. The doe, therefore, has a problem taking in enough energy to feed both the kids and herself, let alone produce milk. Drying her off also gives the tissues of her udder a rest, and will let her produce more milk when she freshens. If she has had mastitis during the lactation now ending, a

dry-cow treatment when you dry her off will help prevent its flaring up when she comes into milk again.

Give the doe a booster shot of 8-way or similar clostridial vaccine 4-6 weeks before kidding. If you are not sure she has been vaccinated before, or if you know she hasn't, you must give the vaccine twice – at 8-10 weeks before kidding and again 4 weeks later. This will protect her and the kids from malignant edema (common in fresh does), tetanus and enterotoxemia (a killer of kids). The vaccine can only be used the day it is opened, so share with a neighbor to cut costs. You must be as clean as possible with this vaccine, as it will cause sterile abscesses to form. Use a sterile needle to withdraw the vaccine, and soak the injection site with alcohol beforehand.

Selenium deficiency causes white muscle disease in kids. If this mineral is lacking in the doe's feed, you must give it to her either in her concentrate or the mineral mix, or by injection 4 weeks before kidding.

Vitamin A must be fed or injected most of the winter. Even very green hay can be deficient in this vitamin, which is extremely important to reproduction.

Let the doe outside on nice days for exercise and to get a little vitamin D. Putting some hay in the outside feeder will encourage her to go through the snow.

By gradually increasing the proportions of grain or concentrate in her diet, and by supplying good quality roughage, you may make up for the decrease in her digestive capacity. With fat or very lean does, there is a danger of ketosis; the doe will go off feed and, within a few days, may start convulsing and then die. Watch out for the early signs and force-feed (if necessary) propylene glycol. Sometimes you have to induce labor and abort the kids to save the doe.

Try to prevent unnecessary stress from bullies, dogs, etc.

Recognizing problems

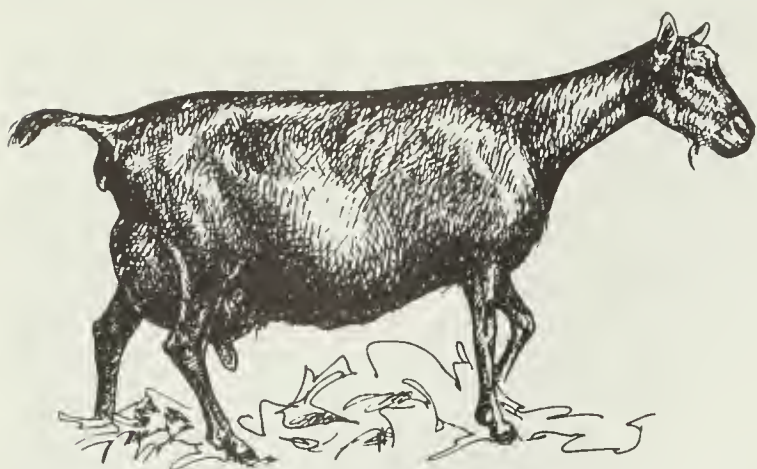
Learn to recognize normal kidding; don't interfere unless you have to.

The doe may or may not go off feed, appear restless, paw her bedding, look behind her and call plaintively, lick your hand and strain slightly every 5-10 minutes.

Older does may show no udder development until a few days before kidding. As the time approaches, the udder will fill up all at once, giving it a shiny, tight appearance. A young doe may 'bag up' (fill her udder) a month ahead of time.

A week or so before kidding, the ligaments connecting the pelvis and the tailbone relax, creating a hollow above the pin bones. As the kids line up in the birth position, the doe may look less bulky, and hollow in the flank.

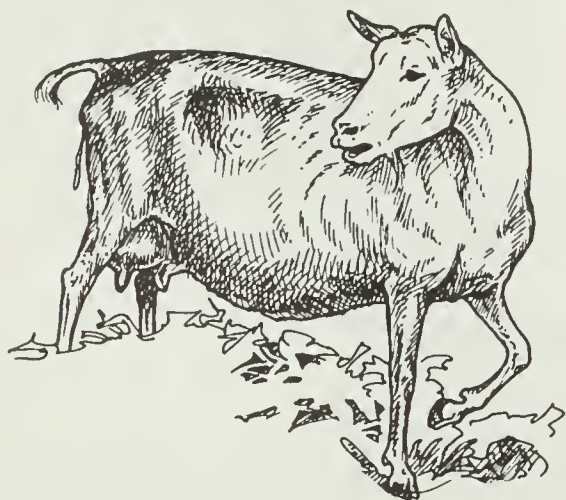
Figure 31 A doe showing signs of near kidding



The vulva may appear swollen for some time before kidding; when labor starts, the cervical plug is discharged as a clear, straw-colored string of mucus. Many does have a continuous or sporadic flow of mucus during pregnancy. If the discharge is whitish or creamy, suspect vaginitis and consult your veterinarian.

The doe's temperature may drop 1-2 degrees 12-24 hours before kidding. Her ears may feel cold, or you may try taking her temperature; the normal rectal temperature is 39-40°C.

Figure 32 The first stage of labor



First-stage labor is often difficult to observe accurately. Older does seem especially blasé and may show little disturbance until well advanced. Younger does may be restless for 24 hours. If uneasiness is prolonged, examine inside the doe – a clean, careful examination will do no harm. If the cervix is tightly closed, the doe is not ready to kid. If it is slightly open, examine her again in

2 hours if she hasn't started straining strongly; if the cervix is closing, you may need help from a veterinarian.

As the first stage progresses, the doe will strain harder. She will arch her back and cock her tail for several seconds every few minutes, or more often as labor progresses. She will empty her bladder and rectum before reaching the second stage when the kid starts out of the womb. Most goats will lie down at this point, at least briefly, but if yours doesn't, don't force her.

Figure 33 The second stage of labor



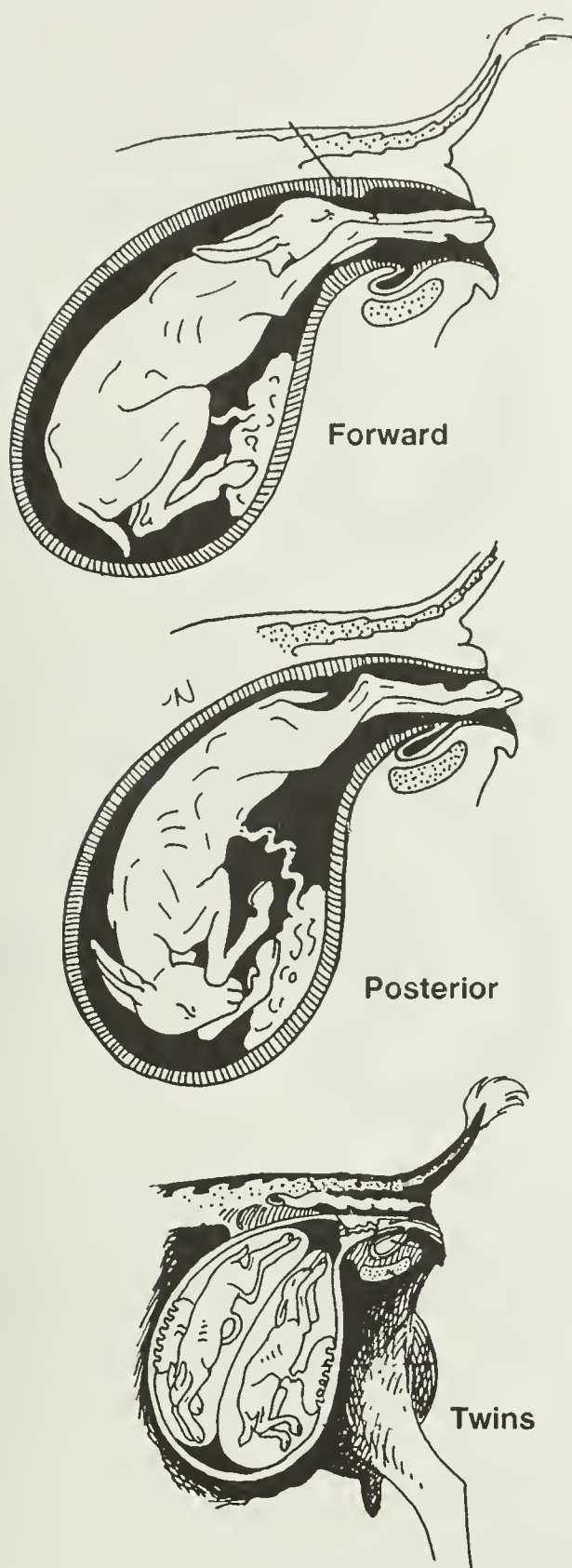
The second stage begins as the water sac (amniotic sac) gets pushed through into the front of the vagina. The cervix is now three-quarters dilated. The pressure of the water sac is important in dilating the cervix, so be careful not to break it during an examination.

Once the water sac breaks, the off-and-on pressure of the head against the cervix will help it dilate fully. At this point, the hooves poke out and the nose can be felt in the vaginal canal. Don't pull on the feet; it will only jam the kid in the cervix and possibly injure the doe.

After the head comes through the cervix, the rest is easy. The doe may decide to take a 'rest' once the head is out – sometimes for many minutes. Contractions continue, however, and the pressure is important to help clear mucus and fluid from the kid's respiratory passages.

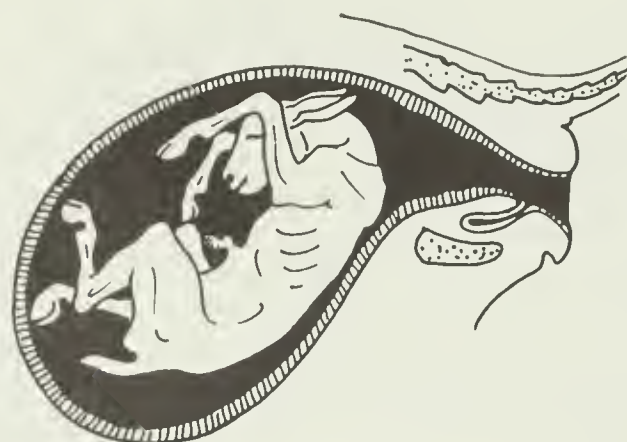
The final push will most likely rupture the umbilical cord, if it hasn't already broken. Until the cord is severed, the kid won't try to breathe on its own because it still receives nourishment and oxygen from its mother. If the cord is still intact when the kid is born, tear it with your fingers, several inches from the kid's body.

Figure 34 Normal presentations



A posterior presentation, where the hind feet exit first, is normal. Generally, this is the position in which the second or third kid is presented; by this time, the cervix is fully dilated and delivery is very fast. In the case of a big first kid presenting its hind feet first, however, there is danger that the umbilical cord will break before the head is out, letting the kid drown.

Figure 35 Upside-down position



First, make sure that it is the hind feet that are coming. If the kid is upside down with front feet coming first, the soles will be uppermost as well. In such a case, turn the kid right side up by gently rotating it until it is in a normal position. If the hind feet are presented, you may have to help the doe by applying traction to the hind feet to hasten delivery. **DO NOT PULL!** Wait for the contractions to increase pressure and remove the kid without force. Remember to follow the natural pathway in an arc.

WHEN SHOULD YOU CHECK? If the doe's uneasiness is prolonged (over 24 hours), there may be something wrong. If she has not started labor, the cervix will be tightly closed with a mucous plug. If the cervix is slightly open, check again in 2 hours to see if it has opened further. If it hasn't, or if it has closed, contact a veterinarian.

If the cervix is open enough to admit your hand, check to see that the kid is presented normally. If it is in the right position, withdraw – don't try to pull it out. If stronger labor does not come on within a couple of hours, consult your veterinarian.

Once the doe begins intensive straining, you should see results within 2-3 hours. If nothing shows after 3 hours, check to see if the kid is in the right position. **IF THE KID IS STRAIGHT, LEAVE THE DOE ALONE;** some does just need more time than others. Many times the examination itself will bring on stronger contractions. If the kid is not born within another 2 hours, call the veterinarian. The veterinarian will decide whether to help or leave her alone for a time.

If the kid is not straight, or in a poor position, you've got problems.

Solving problems

If you are not an experienced goat breeder, call your veterinarian immediately if you think a doe is having difficulty. A beginner can seldom differentiate between situations that need help and those better left alone. Even if you are experienced, do not help the doe unless it is absolutely essential,

Before you go into a doe, be absolutely certain your hands are CLEAN. Your fingernails MUST be short. Scrub up with antiseptic and soap, then wash the doe's genital area. Discard the dirty cloths, wash once again and go in with your hand extended and fingers bunched to form a streamlined shape. TAKE YOUR TIME AND BE GENTLE.

ONE-FOOT-BACK POSITION It is best if you can push the kid back far enough to give you room to work. Push gently, gaining ground between contractions. Work your hand along the body, bringing the kid's knee and hoof up and forward with your fingers. Be careful.

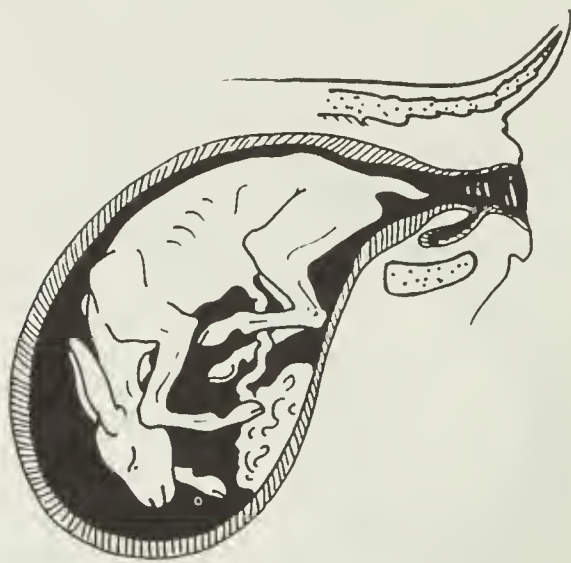
Figure 36 One-foot-back position



If the doe is straining too hard for you to push the kid back, a moderate-sized kid can be born this way with help. Maintain a pulling traction, but let the doe do most of the pushing with her contractions.

BREECH PRESENTATION This creates an 'impossible' delivery. Pull the kid forward and bring each rear leg and hoof up to the exit. If you have to, use a loop of flexible insulated wire to hold one foot in place while you get the other. Once the rear legs are pointed out, you will have to help as with a posterior presentation, to speed delivery. At least by this time the cervix should be fully dilated.

Figure 37 Breech presentation



TRANSVERSE PRESENTATION Push the kid sideways until the rear feet, preferably, are at the exit. Then direct the feet around into the cervix, rotating the kid, if necessary, into a normal posterior presentation. Help the doe by applying traction to the kid's hind feet.

Figure 38 Transverse presentation



HEAD-BACK POSITION A kid cannot be born in this position – you must help. Push the legs back slightly to make room to work, then feel along either side or between the legs for the head. Move it down and around to point out. Be careful of the sharp teeth.

Occasionally, once you have the kid positioned correctly, the head will fall back before the muzzle gets started through the cervix. If this happens, withdraw your hand and wash a strong 1.3m flexible insulated wire in antiseptic and soap. Make a hoop at one end and, after carefully washing your hands again, carry it into the doe on your fingertips.

Place the loop behind the head, under the ears. If you can manage it, make a twist in the loop to go around the muzzle. If you can't, pass the loop through the mouth, but watch out for the teeth, which can easily damage the uterus or vagina if the mouth gapes open.

The free end of the wire will be dangling out of the vulva. Take it in your left hand and, when you get the head into position inside, pull the wire taut. Then, when you withdraw your hand, the head will stay in position. Keep traction on the wire – don't pull, just maintain pressure while the doe does the work.

If the doe is exhausted, you may also have to help with traction on the feet. Just don't hurry. The kid is fine as long as it's inside the doe, with umbilical cord attached.

UPSIDE-DOWN, HEAD-DOWN POSITION First get the front feet into the cervix, then rotate the kid into normal backbone-up position. Proceed to bring the head up as with the head-back position, using insulated wire as directed.

Figure 40 Upside-down, head-down position



Management after birth

Once the doe has finished delivering, put her up on the milkstand, give her some grain, and milk her out halfway on each side. Before kidding, a first freshener should be made accustomed to being up on the stand and having her udder handled. If she overreacts, be as patient and soothing as you can; she will instinctively wish to be milked out but you may have to persuade her to relax. Partial milking may also cause uterine contractions that will help her rid herself of the placenta (afterbirth), if she hasn't already done so. If she doesn't expell the placenta within 24 hours, call your veterinarian. Do not attempt to pull it away; you might cause the doe to hemorrhage. Remove all of the placenta from the pen and burn it if possible. Do not leave it where other goats can contact it, even indirectly. Spread a layer of fresh straw in the pen, make sure the doe has water, and leave her quietly while you take care of the kids.

Figure 39 Using wire to correct a kid's position

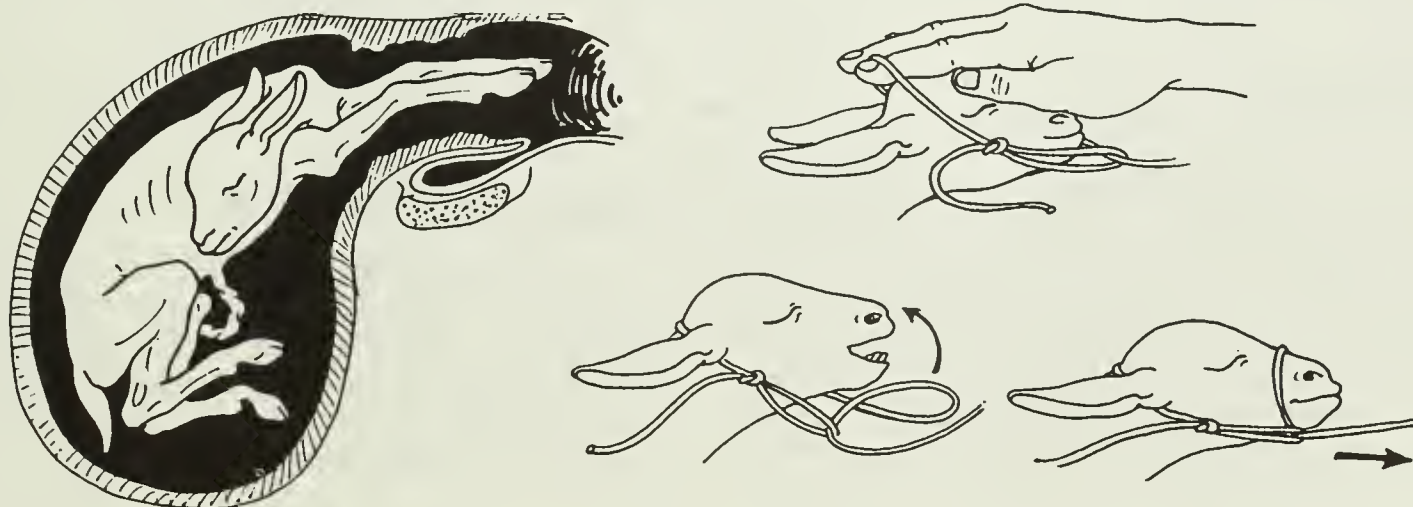
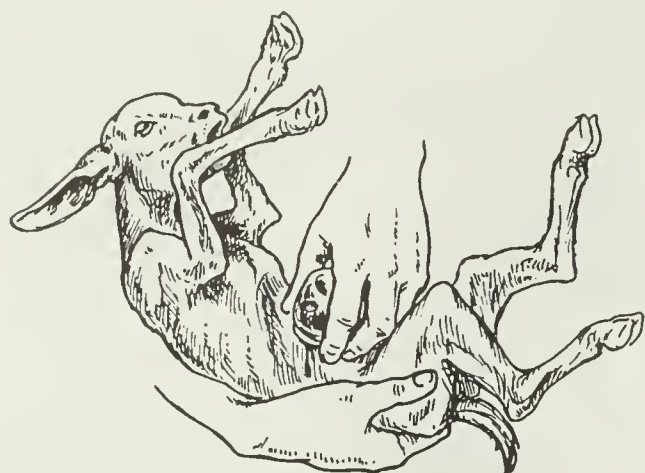


Figure 41 Dipping the kid's navel



It is very important to dip the kid's navel in a 'tamed' iodine solution as soon as possible after it is born. Put the solution in a baby food jar, dip the navel into it and press the jar tight against the belly, then turn the kid upside down.

DISBUDDING

Disbud kids within their first 3-10 days, as soon as the horn buds can be felt. The preferred tool is an electric disbudding iron with a special tip for goats. Don't disbud until you can feel the buds – some kids are naturally hornless. Many established goat breeders are willing to teach you this procedure or do the job for you. You might also consult your veterinarian.

CASTRATING BUCK KIDS

If using elastrator bands, castrate the kids within their first week. After that time, you can use burdizzo clamps or a knife, but get the job done before the bucks are 10 weeks old as they could be fertile by then.

TATTOOING

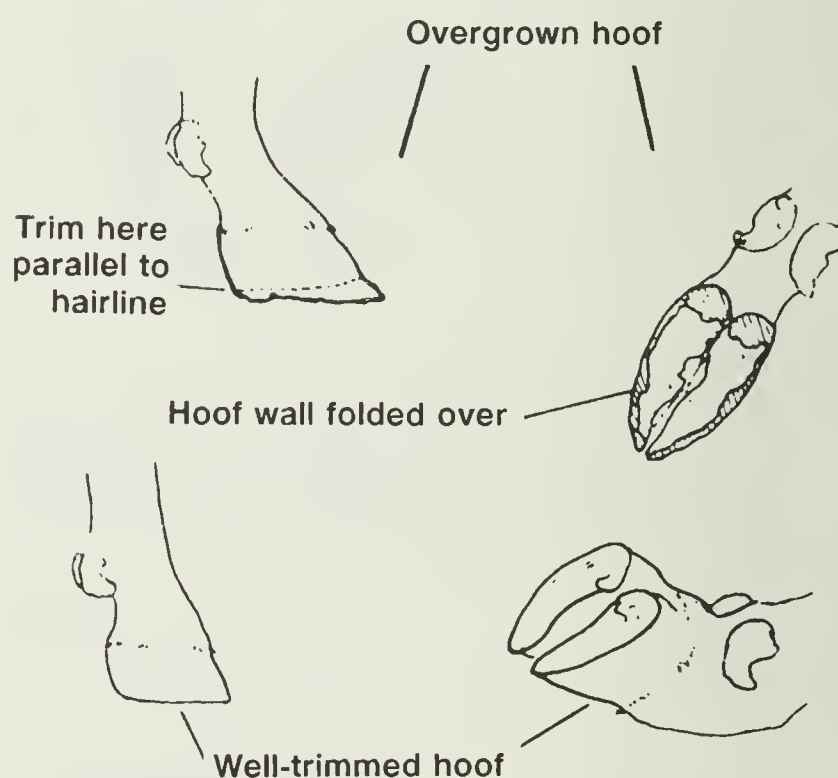
This is easiest while the kid is small, and is a must if you maintain a herd of purebred or Canadian goats. You can use cattle- or dog-tattoo equipment. Dog equipment has an advantage in that the letters are small and fit easily in the ear. The pins are also closer together, which make the tattoo easier to read after the animal reaches 5 or 6 years of age.

HOOF TRIMMING

The goat's hooves grow, much as human hair and fingernails. When they grow too large, they stress the goat's pasterns and legs with each step it takes. You must begin trimming the animal's hooves as soon as it reaches 1 month old; and continue on a regular basis, at least four times a year.

Most owners use a trimming tool called the burdizzo foot rot shear, available at farm supply outlets. Figure 42 shows the technique.

Figure 42 Before trimming a hoof, always examine it. Its bottom should parallel the hairline at its top, and be flat and wide to carry the animal's weight. As you trim the pad, put the foot down often to check your progress. Make sure the finished hoof is flat and level from side to side and from front to back, so it won't strain the pastern. Trim only until you see a slight pink color; any deeper will cause bleeding (if blood does appear, spray the wound with a disinfectant). If the animal has misshapen feet, you may have to trim several times over a period of weeks to correct the problem.



THE MILKING DOE

Before the doe freshens, her udder starts to develop in response to hormones produced by the placenta. Sometimes a young unbred doe will develop a small udder and start producing milk; she should not be milked, but dip her teats regularly to avoid infection.

Figure 43 The parts of the dairy doe

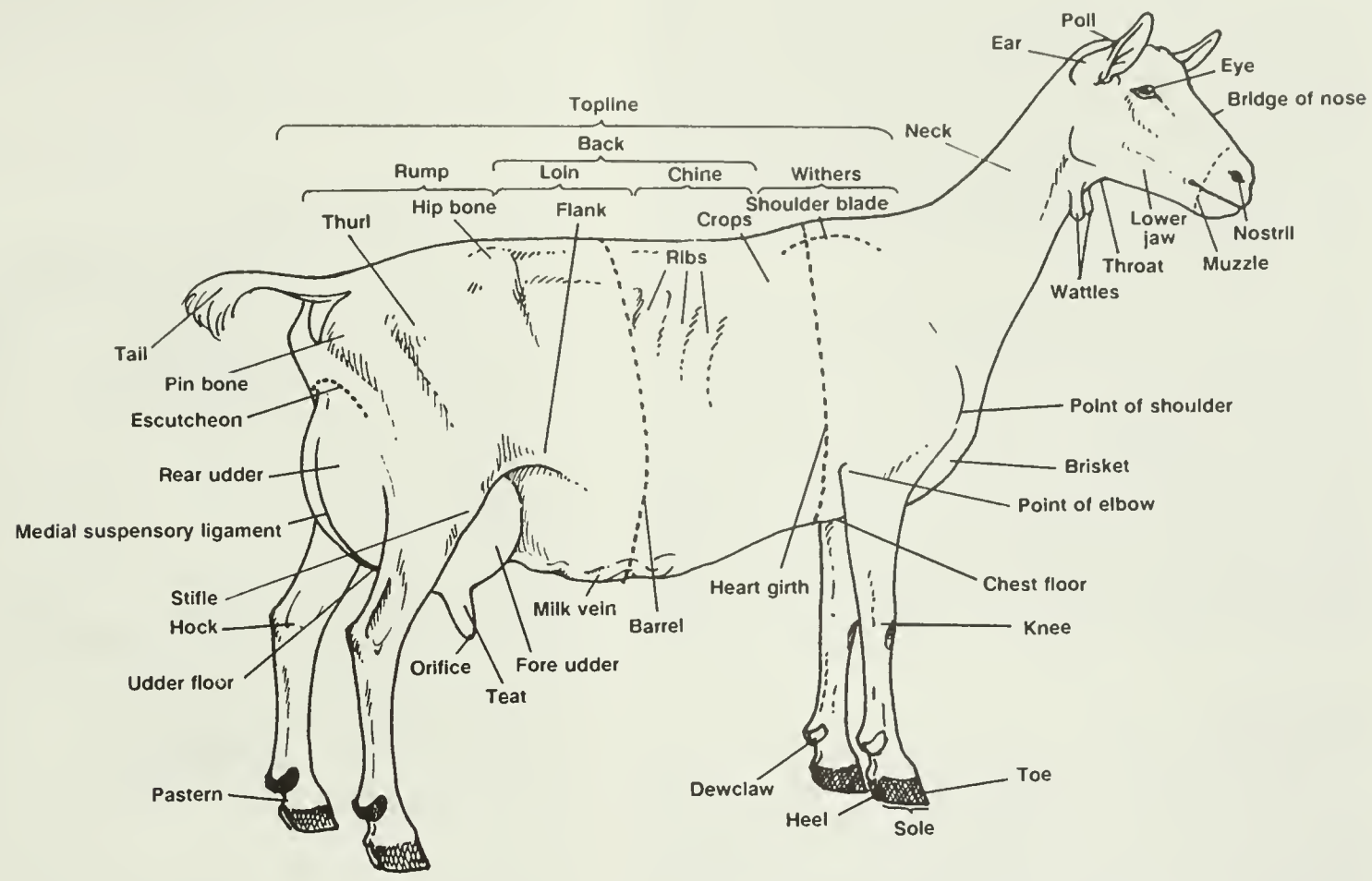
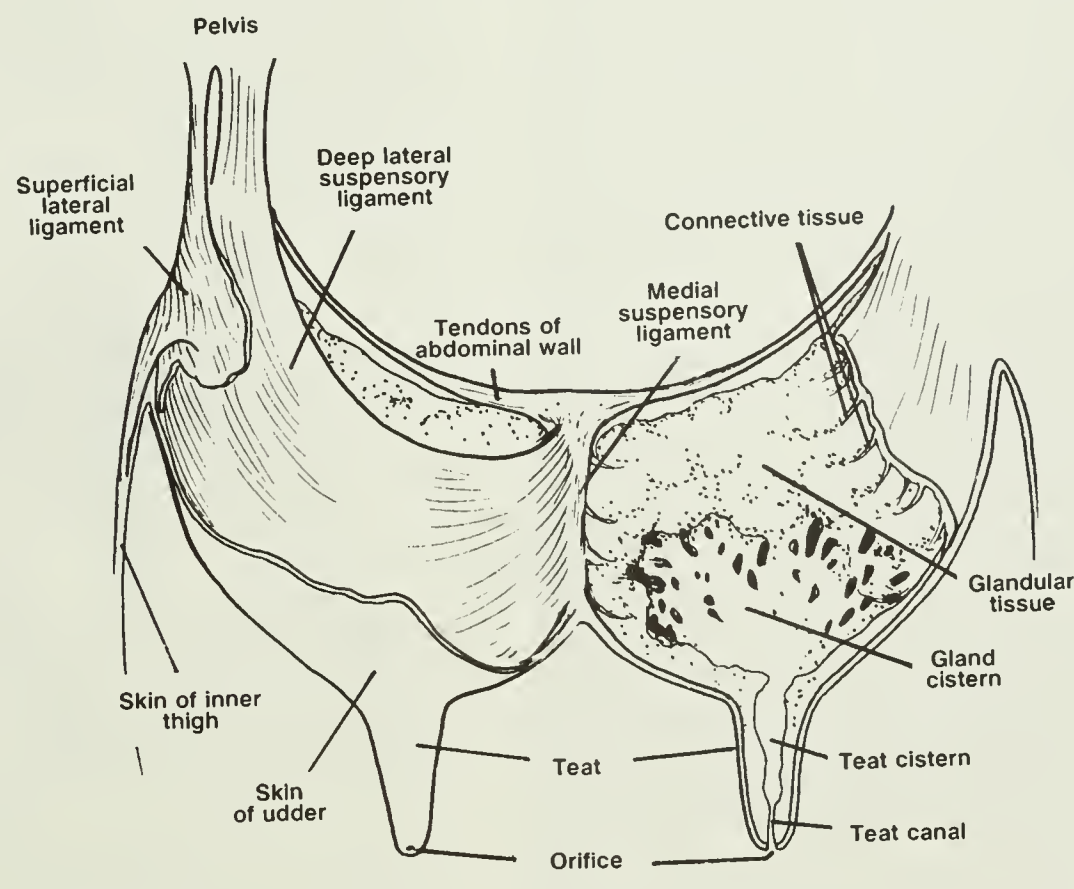


Figure 44 The parts of the udder



The udder is supported in a sling-like arrangement of ligaments that arise from the pelvis; the medial ligament originates in the strong tendons of the abdominal wall. Lateral and medial ligaments join to support and isolate each half of the udder. Connective tissue embedded in the glandular tissue also helps support the spongy glandular tissue inside. The goat manufactures her milk in the tiny spaces, or alveoli, in this spongy tissue. The alveoli empty into ducts that in turn empty into the cisterns of the gland and the teat.

When the goat anticipates being milked, she releases a hormone (oxytocin) into her bloodstream; this causes a contraction of the smooth muscle that surrounds each of the alveoli. The gland is, essentially, squeezed like a sponge, and the milk is forced into the cistern where it can be milked out more readily. This is called milk letdown, and is triggered by whatever the goat recognizes as the routine leading to milking – the clanking of pails, the grain feeding, the udder massage.

Milking

Goats like a regular routine at milking time. Try to milk around the same time each day, and follow the same procedure each time. If you must change your hours of milking, do it gradually over a period of several days, extending or lessening the intervals between milkings by a little each time.

Try to maintain an atmosphere of calm during the milking. Use common sense to avoid upsets; be sure gate latches are in good repair, don't let too many goats in at once, don't leave a half-full bucket of milk under a goat while you go off and do something else, and so on. First fresheners often give the most trouble on the milkstand, but don't yell at them because it will just frighten them and prevent them from letting down their milk. Make the milking as pleasant an experience for them as you can. Pet them, feed them a treat and talk calmly to them.

If, after a few days, a doe continues to go into hysterics every time you touch her udder (and if you're sure she doesn't have a painful case of mastitis), the time may have come to get firm. Many breeders find it simplest and least traumatic to tie the doe's feet to the rear of the milkstand with a short cord, so that she can only kick backwards. When she starts to kick, they remove the pail and wait patiently for the doe to get tired, then start milking again. This all takes time, of course, but eventually the doe will come to her senses if you persist patiently, and that is much easier to do if you aren't sitting or slipping around in a pool of spilled milk.

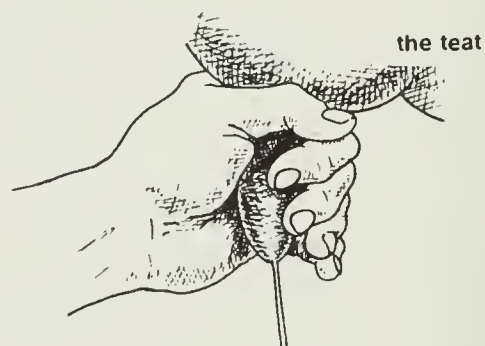
Before milking, wash the udder with warm water and a mild disinfectant, and dry it thoroughly

with a clean paper towel. Milk the first few squirts into a 'strip cup' (a cup with a dark screen across the top) to see if the milk contains any solids that could indicate the early stages of mastitis.

Figure 45 How to milk a goat



Grasp the teat at the top, trapping milk in



Close the fingers from the top down



Press milk out of the orifice



As the udder becomes emptied, massage it to promote final milk letdown

Don't overmilk the udder. Strip the final squirt out of the teat cistern and dip or spray the teat with antiseptic teat dip. Don't use an irritating dip; chapping the skin on teats and udder can permit infection to enter the gland. Consult your dairy specialist or veterinarian.

Milk handling

You have to handle milk properly to retain its quality. If you are just using it to feed livestock, you may take a few more liberties than if it will be used by humans. But please don't forget the importance of hygiene – sanitary milking procedure, clean hands, clean teats and teat dipping. These all play a role in udder health.

Milk pails should be clean, and this is easiest with stainless steel; aluminum is a lower-cost alternative. Plastic is porous, and can harbor off-flavors and bacteria to taint the milk. Metal containing copper may also taint flavor. Wash the pails immediately after use with household detergent and warm water, scrubbing with a stiff brush, then rinse with hot water. Chlorine bleach may be used to sanitize, providing you rinse the pails generously afterward, then let them drain dry. Treat all utensils and glass jars used for milk in the same fashion.

During milking, take care to see that no hair or dust drops into the milk from the goat's body. Goats should have hair trimmed from belly, flanks and thighs to prevent contamination. Brush these areas off before you start milking.

Filter the milk through a commercial milk-filter disc for best results. The sooner the milk is filtered after it is removed from the goat, the less bacteria or other contaminants it will contain.

After milking, either cool the milk quickly or pasteurize it at once. Bacteria can double in number every 20 minutes in room-temperature milk, but cold slows them down considerably. Pasteurization kills perhaps 98% of the bacteria but the remaining 2% can ruin the milk if it is not cooled quickly. In addition to bacterial contamination, rancidity occurs if milk remains around 29°C for any length of time. The faster it passes through this temperature zone, the better the milk will taste.

Milk quality

Milk should, above all else, be safe to drink. If you keep the microorganisms in the milk to a minimum by maintaining the health of the animals and observing strict sanitation in milking and milk handling, the possibility of transmitting infection through the milk will also be minimized (within the limits of the goats' health).

To reduce risks still further, we strongly recommend you pasteurize all milk unless you sell it to a dairy that looks after this. You can either buy a small home pasteurizer, or treat the milk in

a double boiler. If you opt for the latter, put the milk in the top container, water in the bottom, and heat the milk to 62°C (you'll need a dairy thermometer). Hold it at that temperature for at least 30 minutes, stirring to maintain uniform heating. Then cool the milk quickly by immersing the container in ice water.

Alternatively, you can heat the milk to 90°C and hold it at that temperature for 15 seconds.

Milk should taste good. There are many reasons for off-flavors to develop in milk:

RANCIDITY Lipase enzymes in raw milk cause fat to degenerate into short-chain fatty acids with a 'goaty' taste. Change occurs fastest around 29°C.

MICROBIAL ACTION Many organisms can grow rapidly, producing a variety of off-flavors from fruity to putrid by causing chemical changes in fats, proteins or carbohydrates of the milk. If the udder itself is infected, these changes can be happening even before the milk is removed, and it will taste bad even when fresh.

CHEMICALS As mentioned earlier, contact with copper will cause rancidity quickly. Chlorine bleach used to clean plastic pails will also impart a strong flavor for some time.

WORMS A heavy worm burden causes changes to the goat's metabolism that gives her milk an off-taste.

FEED Strong-tasting feeds and pasture plants may impart strong flavors to the milk. Stinkweed is particularly offensive, but other plants (poplar, spruce, pine, alfalfa, silage, etc.) have also been blamed, rightly or wrongly. If you feel any of these is causing a problem, keep the goat from eating it for 4 hours before milking. A lack of cobalt in the diet has been implicated in several cases. Extra vitamin E in the feed has been reported to improve milk flavor.

GENETICS In Norway, strong-tasting milk is much in demand, and people breed goats for it. Canadians want a bland product, so hopefully we will have success in breeding for that quality. There is now a suggestion that milk with a butterfat percentage lower than the protein count tends to have a less desirable taste. Butterfat and protein levels are genetic factors, though some environmental conditions can also influence them.

MASTITIS Whether or not you have reason to suspect mastitis, test the milk regularly for a high somatic cell count. If your provincial laboratory analyzes your milk on a regular basis as part of a milk-testing program, you may be getting somatic cell-count readings. Watch for a sudden rise in the number of somatic cells in the milk, which could indicate infection in the udder. Readings over 1 million millilitres (1000 is marked on the analysis sheet – multiply by 1000 as

indicated at the top of the column) should alert you to the possibility of mastitis, unless the doe is very fresh or nearly dried off. Generally, a count under 1 million is normal; readings over 500 000 may indicate other types of irritation in the udder, such as 'bagging up' for shows, or kids nursing, etc. Readings under 100 000 indicate very clean milk but an udder that may be susceptible to *E. coli* infection if bedding is damp or excessively dirty.

The California Mastitis Test (CMT) is available through your veterinarian or farm supply store, and detects high cell counts very accurately. By mixing equal amounts of milk and diluted CMT solution, the number of somatic cells can be estimated by the degree to which the mixture gels. A CMT reading of two or greater may indicate mastitis.

Mastitis may be confirmed both by culture of samples obtained aseptically and by observation, as acute cases cause quite rapid changes in the milk. A few flakes on the screen of the strip cup may become, by the next milking, cheesy curds in a watery solution. The udder may become hot and swollen, and the secretion may change drastically; milking will become difficult and very painful for the doe. Treat mastitis as early as possible, and do not use mastitic milk, treated or untreated, to feed replacement kids, and certainly not humans.

DISEASES

While goats are known the world over as "survivor" types, the high-producing dairy goat does need some special care to maintain both her health and production. Lactation is extremely demanding physically and can lead to lowered disease resistance unless nutrition and management are well taken care of. Properly fed, the goat's body has the energy and stamina to resist diseases; kept in a clean, well-ordered environment, she will be challenged by infection less often, and have the sense of well-being that lets her breeze through any short-term stresses she may have to meet.

A growing kid also risks health problems. Here again, nutrition is important, but many of the nutritional problems can stem directly from management shortcomings. A heavily parasitized kid, for instance, will not make full use of its rations and will be more susceptible to infection. A kid must acquire resistance to most types of infection and, until it does, should not be exposed to heavy concentrations of disease organisms.

Prevention of disease by balanced nutrition, sanitary management, regular vaccinations and sensible grouping of animals makes good economic sense. Veterinary expenses, drugs, long hours of nursing care and lost production can turn a self-supporting operation into a serious money loser in a very short time.

Infections

Infectious diseases are those caused by a bacterium or virus. Although many are contagious – that is, passed directly from one animal to another – others are not, but are picked up from the environment.

Your goal should be to avoid a buildup of infective agents to which your goats may become exposed. For instance, the manure of older animals often contains disease organisms that younger kids have no resistance to; the kids may contract the diseases simply because of the organisms' numbers. The fewer organisms in their environment, the greater the chance they will never show signs of disease but will develop some resistance. In some cases, they may become carriers of a disease even if they have never been seen to have it; recovered animals also may become carriers.

Disease may also transmit through the placenta and fetal membranes at kidding time, and through the vaginal discharge following kidding. The likelihood of infection is even more severe if the animal is aborting. You can reduce the chances of a serious problem spreading throughout the herd by following a few management rules:

- In a small herd, where pregnant and fresh does are kept together, keep bedding bright, fresh and dry. Walk through the herd several times a day and check for reddish-brown discharge. Isolate these goats, then find and eliminate any discharge or fetal material in the bedding. This method of control is possible in a small herd if the likelihood of infection is low.
- Where possible, separate does in late pregnancy into small congenial groups. Many goatkeepers feel a particular abortion may have been the result of a blow from a bully in the herd. Eliminate that possibility if you can.
- Isolate does in the kidding area shortly before second-stage labor. Make sure they have clean bedding to the ground, if possible, because the first thing they will do is dig up the bottom layer and bring it to the top.
- Remove placenta and fetal membranes and burn them.
- Clean out the kidding stall immediately after kidding, and bed with fresh straw. The doe may remain in the same area for 2-3 days and will benefit from the isolation, even if she does complain (sent out into the herd, she would complain just as much). So if you can spare the space, keep her there, bedded well and away from bullies.

If possible, does entering the milking herd right after freshening should be kept in the cleanest area of the barn. If you can't partition off part of the barn for them, be sure the whole area is kept especially dry, bright and clean.

Most infective organisms thrive on dampness in the bedding or in the air. Airborne infections most often affect the respiratory system, although some may simply use the lungs to gain entry. Even so, the animal may be able to resist a light attack if the mucus lining its respiratory tract is healthy. Ammonia in the air dissolves mucus like your ammoniated window cleaner dissolves grease on glass – don't close goats in during winter unless you have a good ventilation system. Vitamin A is also vital to the health of mucous membranes.

To some extent, you can discourage oral transmission, as when the goats accidentally eat manure or placental material. Present the animals with clean feed in feeders they have no chance to contaminate, and provide enough feeding stations that even the most timid animals get a chance at the good parts. Goats will always do some absent-minded nibbling on bedding if there is any around, or even on walls or partitions if they are bored. A certain amount of fresh air and exercise, even in high-producing herds, is therefore recommended; besides saving the woodwork, it will give the goats a little more interest in staying healthy.

Nutritional deficiencies

Symptoms are many and varied, according to the deficiency. Usually more than one animal in the herd is affected, although one or two individuals may show symptoms earlier or more intensely than others whose requirements may not be quite so high.

An analysis of your feed supply early in the season will help you avoid deficiencies of energy, protein, minerals and vitamins before mid-winter adds to the likelihood of illness.

The section on nutrition contains descriptions of many deficiencies; some other metabolic disturbances stem directly from nutritional problems.

KETOSIS A disease of late pregnancy, ketosis is especially common in fat animals carrying two or more kids. A day's interruption in feed can bring on the symptoms. First, you may notice a lack of appetite. Start treatment immediately, with a drench of propylene glycol (100-200 mL, twice a day) to any late-pregnant doe that looks the least bit off. If you're wrong, at least the propylene glycol won't hurt her. As the disease progresses, more symptoms develop – listlessness, leaning against objects, twitching face muscles, grinding of teeth, and then progressive loss of reflexes, blindness, and eventually coma and death.

Progress takes only 2-5 days, and treatment is very difficult once a certain point has passed. However, you can alleviate the problem by aborting or taking the kids by Caesarian section. In most cases, the infected kids will not survive. Better the dose of propylene glycol a few days earlier, or better still, prevent the doe from becoming too fat in early pregnancy.

A word about propylene glycol – there is nothing quite like it. A number of 'ketosis remedies' contain other molasses- or sugar-based compounds, but propylene glycol raises blood sugar the fastest, even if it does cost a little more.

MILK FEVER The symptoms are much like those of ketosis, only happen much, much faster. The disease may occur any time from 6 weeks before kidding to about 10 weeks after. It is caused by a sudden drop in calcium in the blood caused by overfeeding calcium during late pregnancy. This makes it impossible for the doe to absorb enough calcium from her feed to meet the demands of milk production, and prevents her from using the stores of calcium deposited in her bones, as she would normally do.

To prevent milk fever, reduce the calcium-phosphorus ration in the doe's feed to less than 2:1 by feeding her grass hay instead of legume hay in late pregnancy, and supplementing the energy and protein in her concentrate.

To relieve the symptoms, administer calcium to the doe by intravenous or subcutaneous injection. The intravenous method gives faster results, but solution must be given slowly to avoid palpitations of the heart.

GRASS STAGGERS (hypomagnesemia) This may strike suddenly when does are in milk and grazing on fast-growing, lush grass pasture, or may develop over 2-3 days. In the latter case, the doe may become nervous, walk stiffly or start at sudden noises. She may urinate frequently. This progresses to an acute stage, with frenzy, convulsions and death.

Fast-growing grasses and wheat cannot take up enough magnesium to support grazing animals, especially in damp weather. This cool, damp weather also creates a susceptibility in the animals, particularly if they are not receiving forage under cover. The animals go out to pasture hungry, gorge on low-magnesium grass and suffer grass staggers.

You must treat the goats immediately. A subcutaneous or intravenous injection of calcium-magnesium-glucose solution will stop the immediate symptoms, but administer magnesium by mouth for several days following to prevent relapse.

POLIOENCEPHALOMALACIA Called polio for short, this is brought about by a deficiency of vitamin B₁ (thiamine). Ordinarily, rumen microflora

manufacture this vitamin in good quantities, but occasionally something upsets this situation. Changing feed too quickly to higher energy rations, overuse of molasses or a cobalt shortage have been blamed for the sudden destruction of thiamine and the onset of polio symptoms. The goat may go off feed, then become unsteady and begin staggering, apparently with impaired vision. It becomes nervous, suffers muscular tremors, and may stand with its head against a wall. Convulsions and death may follow.

The sooner you notice and treat the condition, the faster the recovery. Thiamine or vitamin B complex, injected intramuscularly or intravenously or both, will correct the problem but may have to be repeated for a day or two afterward until the rumen function is restored. Vitamin B given orally as a drench may also help. Following treatment, reduce the grain in the ration and give the animal good forage for 5-7 days.

Digestive problems

Collectively, these are the most common diseases, although goats may not have as many problems as other ruminants. However, problems do occur, and may be prevented from progressing to more serious diseases if you remain alert.

TEETH An overgrowth of the outside edges of molars often causes problems for goats 2-3 years old. The molars' sharp edges scratch the inside of the cheek. Often the animal will pack cud in between the cheek and the tooth to soothe the irritation; you will see a lump that comes and goes on one or both sides of its mouth. File the teeth with a coarse wood file and give the goat light antibiotic treatment for 2-3 days to prevent infection.

HARDWARE DISEASE This occurs when animals eat metal objects such as nails or wire. Goats, being sensitive, selective eaters, seldom have this problem.

INDIGESTION Any quick change of feed can bring about the initial symptoms – depression, lack of appetite or pasty, foul-smelling feces. If too much grain has caused the problem, try giving the goat milk of magnesia by mouth; if it has eaten too much protein supplement, give it vinegar in water.

When the animal stops chewing its cud, rumen activity has ceased. You can capture the cud of a healthy goat, dilute it in warm water, and administer as a drench to the affected goat. This speeds up re-establishment of the rumen flora and the action of the rumen will help break up any obstruction. B vitamins administered by mouth will also help encourage rumen organisms to grow and reproduce.

GRAIN OVERLOAD This condition usually shows up after a goat gets into the feed illegally and packs it into an empty stomach. Protect your grain and supplement from accidental invasion for the sake of the goats, if no other reason. In this very serious condition, the rumen becomes very acid; the goat becomes depressed, goes off feed and develops diarrhea. Acidosis and dehydration lead to death in 1-3 days. Your veterinarian may have to open or otherwise empty the rumen to save the animal.

BLOAT Goats are less prone to bloat than many other animals, but certain types of pasture, such as wet clover in early summer, may lead to serious problems. The rumen fills with a frothy liquid that the goat can't burp up as a cud; the rumen becomes painfully distended and may kill the animal by suffocation. In most instances, you can alleviate the worst of the symptoms with a dose of mineral oil, peanut oil or tallow, then by keeping the animal on a diet of coarse dry hay for several days following. In fact, if one animal bloats, it may be a good idea to increase the dry roughage in the herd's ration to prevent other cases.

Some goats will bloat if they have a heavy burden of intestinal parasites. Worm them with an effective wormer, and see if the problem stops. A few animals just seem to be chronic bloaters, but they don't seem to suffer from it a great deal. Occasionally, baking soda in the grain ration seems to give good results.

BACTERIAL DIARRHEA In young animals, diarrhea may result from any of several causes. In a newborn kid, 1-3 days old, bacterial invasion is most often the culprit. If it ingests infected manure at the first feeding, from dirty teats or the doe's hair, this overwhelms its unprotected digestive system with bacteria, which attack the lining of the intestines. Diarrhea occurs because the walls of the intestine no longer allow the body to absorb water; excessively watery waste washes out of the body, carrying nutrients and vitamins the animal needed. Dehydration of body tissues poses the most immediate threat to life.

To save an animal from dehydration, administer an electrolyte solution by mouth. A young kid will drink the solution eagerly if used to the bottle, and the electrolyte should be substituted for its milk ration. Do not feed it milk until the bacteria are eliminated (with antibiotic treatments if necessary). Some powdered electrolytes contain enough nutrition that young kids may be fed quite safely for several days before going back on milk.

An emergency electrolyte solution is 2.5 mL salt, 5 mL baking soda and 30 mL white corn syrup in 1 L of water. Use this only until you can obtain a more complete solution containing vitamins and important nutrients.

Parasites

COCCIDIOSIS In kids over 3 weeks old, a darker-colored diarrhea may indicate a severe infection by a protozoan parasite, *Eimeria*; the disease is known as coccidiosis. All goats carry some of these organisms in their intestines, but older animals usually become very resistant. Adults shed oocysts (a developing form of the organism) intermittently; under warm, moist conditions, these develop quickly into an infective form which, when it enters the digestive system of the young goat, releases many offspring. These in turn invade and damage the lining of the digestive system, multiplying rapidly in the absence of any resistance. Sometimes they also infect other systems; the respiratory or the nervous systems may be at risk, producing coughing and pneumonia or, more rarely, convulsions and paralysis.

Symptoms of an early infection include lack of appetite, hunched posture, lack of condition or dehydration, dry skin or hair, anemia and, finally, diarrhea. Much damage has been done by the time diarrhea appears, so start treatment as soon as you suspect the infection. One very effective control starts before the kids are born. Decoquate or lasalocid added to the salt in the does' quarters 4-6 weeks before kidding will minimize the numbers of oocysts in the area. If you intend to raise kids with the does, this early start is a must. Present kids, in any case, with the same salt mixture from birth. Both products are very safe and, because fed in such small quantities, require no withdrawal time before slaughter. This treatment does not eliminate coccidia entirely within the animals or their environment, but slows the parasites down considerably, allowing the kids to develop their own resistance.

The cheapest and one of the most effective ways to deal with the threat of coccidiosis in young kids is good sanitation. Very young kids, in particular, should not be exposed to excessive amounts of manure from adults or older kids. Keep kids' yards clean, use feeders that prevent contamination of feed, and maintain a good layer of clean straw in any area where they are likely to lounge. Isolate animals with diarrhea. Between each lot of kids, clean out the pens and allow these to dry thoroughly; hydrated lime helps to dry and disinfect.

Other control treatments include amprolium in milk or drinking water for a minimum of 5 days. Give the kids B vitamin supplements if treatment continues any longer. Sulfamethazine, sulfaquinoxaline or one or two other sulfonamides give excellent results in treating diarrhea or the earlier symptoms. Administer the solution in a drench, by mouth, since most animals will go thirsty rather than drink water treated with the drug. Two or (at most) three treatments with

sulfonamides will control a severe outbreak, but oocysts may increase again quickly during favorable weather.

Oocysts are usually diagnosed through examination of the feces; however, the animals often do not shed oocysts until quite late in the infection. Whenever kids are exposed to even very small amounts of adult manure, assume coccidiosis may become a problem. Kids will grow faster and be generally more healthy if you maintain a regular control program from the time of their birth until well after weaning.

INTESTINAL WORMS Diarrhea in adult does or bucks (or kids over a month old, for that matter) often indicates intestinal worms. Kids, in particular, are very susceptible to such parasites. Fecal examination will confirm an infection, but given the broad-spectrum effect of most modern wormers, you can start treatment on the basis of the symptoms – loss of production, slowed growth, dehydration, anemia and possibly other infection. If any goat in a group shows the signs, treat the whole group immediately.

Kidding lowers the goat's resistance to worms, and in susceptible animals severe infections may follow within a month. You may treat milking does with a wormer approved for lactating dairy animals, if the milk is withdrawn from use as food for at least the specified period. The best time for such treatment is on the day of kidding, since you won't be using the milk for human food for several days anyway. A second treatment 2-3 weeks later may be necessary.

Worms thrive under certain conditions. Goats on pasture during warm, wet weather may suffer heavy infection. These conditions are ideal for the rapid development of worm eggs. You can avoid part of the problem by rotating pastures frequently during such weather, taking care to see that the goats are not turned onto pasture that has been in use during the previous 3 weeks.

One new and very safe worming compound is ivermectin. Unfortunately, it is not approved for use in lactating dairy animals. It is very effective, however, against worm larvae, such as found in goats during the winter, especially during pregnancy. Used at the start of the dry period, this wormer may help reduce the burden in the animal at kidding time, but reinfection may occur if sanitation and feeding are not ideal.

LUNGWORMS A loose, husky cough (especially among young animals during mild, damp weather) gives the first indication of lungworm infection. Diagnosis is by fecal examination. Infection may lead to bronchitis, pneumonia and scar tissue in the lungs but, in many cases, animals recover spontaneously after 3 months or so and then have a high resistance. Treatment with ivermectin is effective, and prevents loss of condition and growth.

LIVER FLUKES Goats avoid swampy pastures if at all possible but, under some conditions, will graze in areas that are infected with liver fluke cysts. These can remain for several months on vegetation that is not completely dried up. The cysts release flukes in the intestine that invade the liver, where they wander and destroy tissue for several weeks before they start to produce eggs. A heavy infection can kill a goat within 6 weeks, following the development of a painfully distended abdomen and anemia. Lesser infections cause anemia, unthriftiness and 'bottle jaw', and reduce performance over a long period. If you suspect liver fluke infection, treat the animals as your veterinarian advises and remove them from suspicious pastures.

NOSE BOTS The nose bot fly deposits its larvae about the goats' nostrils, especially during the warm hours of the day. These larvae migrate into the nasal sinuses, where they continue to grow and cause sneezing, mucous discharge and, occasionally, septic sinusitis or even infections of the brain via the olfactory nerve. Ivermectin may prove effective; ruelen given as a drench will also afford good control.

LICE Sucking lice penetrate the animal's skin and feed on its blood; they may cause anemia that often leads to further health problems. Biting or chewing lice cause itchiness and hair loss. Both types of lice are very irritating and prevent the goats from resting.

Rubbing, scratching and hair loss indicate the goats have lice. Check by parting the hair along the rib cage, flanks or shoulders – if the pests are there you'll see them. The sucking lice (the larger of the two types) are dark blue and may grow as long as 0.3 cm. Chewing lice are smaller and paler.

You can treat lactating dairy goats with insecticides approved for dairy cattle: crotoxyphos, crotosphos plus dichlorvos, and coumaphos. Rotenone is also approved in most areas.

You can treat dry stock, bucks, kids and wethers with the same compounds, or with several others used on beef animals and sheep. Lindane, malathion, methoxychlor, carbaryl and ronnel are some that may be used on dry animals. Use systemic insecticides with care on pregnant animals, as they may cause abortion. Ivermectin is effective against sucking lice, but has little or no effect on the biting lice.

Dust the insecticide onto the skin, rubbing it into the coat along the topline, around the neck and (in particular) the tail. Repeat the treatment 17 days later to kill lice that have hatched in the interval. A third treatment after another 17-day period is recommended.

MITES These tiny arachnides burrow under the goat's skin, causing mange. Mange is a dermatitis with various symptoms, from patches of raw, bald sores that crust over and are extremely itchy, to small non-irritating lumps at the base of hairs. The former condition is the classic type which, although very contagious, is easily treated using ivermectin. Once again, remember that this drug is not approved for use in lactating animals because residues may appear in the milk for up to a month. However, you may choose to dry off the animal and use ivermectin rather than some of the older treatments, which consisted of spraying or dipping animals six times at intervals of 7-10 days, using a lime-sulphur solution.

The less-irritating mite infection, demodectic mange, produces small (up to 8 mm in diameter) swellings in the skin, and is also treatable with ivermectin. However, the condition is often due to a failure of the immune system, and animals may become reinfected several times. Demodectic mange is not particularly contagious and, because it is not so irritating, treatment may be delayed until the dry period. If you need immediate results, however, the cysts may be opened with a sharp blade, the waxy contents squeezed out and disposed of, and the wound painted with tincture of iodine.

TICKS Very few species of ticks can survive as far north as Canada, but one very important variety, the Rocky Mountain wood tick, is found in the west. This parasite carries Rocky Mountain spotted fever, tularemia and Q fever, and is the chief cause of tick paralysis in humans and animals.

If you pasture goats on brush in infested areas, examine them daily for the reddish-brown and silver insects, especially around the head, neck, shoulders, groin and escutcheon.

Tick paralysis usually begins as an incoordination of the hind limbs, progresses over 1-2 days to general paralysis, then causes respiratory failure. If a tick is found, remove it by applying a hot match to its rear until it withdraws from the skin. Do not pull a tick away from the goat, as the head will simply break off and stay in the skin, causing further problems for the animal.

TAPEWORMS These parasites don't usually cause a problem in goats. Even heavy infections cause only mild unthriftiness, digestive disturbances and lowered production, and most goats develop resistance quite quickly. The goats shed portions of the tapeworm in their feces, which may be seen by the naked eye as wriggling white 'worms'. Ivermectin does not affect tapeworms, but several safe wormers such as albendazole and cambendazole have proved effective.

Respiratory diseases

Goats are very sensitive to dampness. Excessive moisture in the air they breathe can be devastating, especially if accompanied by irritants such as ammonia or infective organisms from other animals (who may not show dramatic symptoms of disease). Prevent sharp drafts in the barn, but always allow for a fairly free exchange of air with the outside. Ventilating systems for larger herds include fans and plenums to distribute fresh air evenly.

Other conditions, discussed below, also cause respiratory problems.

LARYNGITIS This most often results from continuous bleating, as by a young kid separated from its mother for a day or a new goat entering the herd. After many hours, the animal can only manage a desperate squeak, which you may find a relief. Be kind to the goat, however; give it a dry place to rest, fresh water and good quality feed that it can eat uninterrupted by others. Such treatment will go a long way in preventing that sore throat from developing an infection.

SHIPPING FEVER (pasteurella pneumonia) Associated with a sudden change in weather or environment, shipping fever begins with a runny nose, depressed appetite and listlessness, then coughing and fever above 40°C. Animals exposed to others that have recently been transported are also vulnerable. Isolate new arrivals for several days and observe closely; if no symptoms develop after a week, the transported animals are probably safe to put with the others. If symptoms do seem to be starting, begin antibiotic therapy immediately. Treatment with a long-acting antibiotic before shipment may help prevent the disease.

ENZOOTIC PNEUMONIA This catch-all term describes pneumonia caused by any number of organisms from viruses to bacteria to mycoplasmas. It usually affects several young animals in a group. The disease may develop very fast, with fever, coughing and rapid, shallow breathing appearing overnight; or the symptoms may appear more gradually, with many of the kids coughing occasionally while the group just shows poor overall growth. The problem is that the initial infection lays the animal open to further invasion by other organisms, and the kid can be overwhelmed and die within a very short time.

As your best protection against this disease, provide the kids with colostrum from older does if possible within 6 hours of birth, and keep adequate vitamin A in their diet. Kid pens must be dry and draft-free; heat lamps are rarely necessary and may just add to your problems.

Once you notice symptoms, treat with oxytetracycline immediately.

FARMER'S LUNG Hay put up damp may overheat, allowing certain molds to grow. A chronic low-grade respiratory infection, farmer's lung results when goats inhale spores of these molds. The major symptoms are poor production and weight loss in mature animals and a general cough in the herd. The disease appears most often in late winter and affects older animals more severely. Treatment is difficult; scarring reduces lung capacity, but often the animals improve greatly by spring. To avoid the problem, don't feed moldy hay if it can be avoided.

ASPIRATION PNEUMONIA Caused by foreign matter in the lungs, this is most commonly the result of improper drenching. When administering medication by mouth, be careful not to raise the nostril above the level of the eyes, allow the goat to swallow properly by drenching slowly, and stop while the animal coughs or bawls. If the animal takes a significant amount of material into its lungs, its chances of recovery are poor. Even if infection does not develop, the goat's lung capacity is reduced and it will become more susceptible to future respiratory difficulties.

When drenching, use a regular 50 cc syringe with a short tube attached. The tube, slipped into the side of the goat's mouth where there are no teeth, should be long enough to reach the back of the tongue.

Diseases causing lameness

Problems in the feet and legs are major reasons for culling dairy animals. These problems are less frequently inherited than acquired through nutritional imbalances, neglected hoof trimming or disease. If you notice lameness, check the possibility of nutritional causes, see if the feet are properly trimmed, then consider whether a disease may be the cause.

ARTHRITIS This means, simply, inflammation of a joint. Faulty conformation can put unnecessary strain on a joint, causing it to swell and become painful. Bacteria or viruses may also invade the capsule of a joint.

Navel ill is an infection kids acquire within a few hours of birth. Organisms invade through an untreated navel cord, settle in the joints and often cause swelling, lameness and heat to appear within a month. A chronic lameness may develop later. In acute cases, a generalized infection may require immediately antibiotic treatment to save the kid. In any case, the kid's development is retarded and lameness may recur more or less permanently.

Suppurative arthritis is caused by wounds near or in a joint, or by long-standing systemic infection (such as metritis) settling in the joint capsules. Bacteria or mycoplasmas can usually be detected in the fluid if samples are taken. Tests may also indicate the drug to be used if you decide to attempt treatment.

Caprine arthritis encephalitis (CAE) is caused by a virus passed to the kid through the doe's milk. This virus can cause a form of paralysis in young kids, but more commonly it lies dormant until the animal matures, at which time it produces arthritis and other problems. Udder edema is common in infected does, and becomes more severe with each freshening. In many cases, a swelling on the upper part of the neck, just behind the skull, indicates the disease. The symptoms of CAE may not appear for 4-5 years in an infected animal, but during that time the milking doe will have been shedding the infective virus in her milk. Her colostrum will also contain the virus. Many breeders attempt to break the chain of infection by raising their kids without ever feeding them untreated goats' milk or colostrum. Heat-treated colostrum and pasteurized milk are safe for kids, but many breeders prefer to use milk replacer or cows' milk, then wean the kids early.

A number of laboratories will check for antibodies to the CAE virus, but the blood tests used are not completely reliable. Many animals who test negative go on to develop the disease, and others show severe symptoms. A positive result means that the animal may develop symptoms at some time. There is no treatment.

Nutritional arthritis attacks the growing goat. It is caused either by a lack of calcium in the diet or a lack relative to the supply of phosphorus, and can lead to bone deformities and lameness. The disease can strike if the kids eat a high proportion of grain but little hay or other forage. Even if grain is measured out, be sure that the kids also eat their allotment of hay, or cut back on the grain until they do. If that is undesirable, offer limestone or another calcium supplement in the salt mix. Symptoms include an obscure lameness, weakening of the pastern and 'knock-kneed' front and hind legs.

VITAMIN D DEFICIENCY Too little of this vitamin will cause softening of the bones and, consequently, bowed legs.

WHITE MUSCLE DISEASE A selenium deficiency is the most immediate cause of this condition, although injections of vitamin E will help prevent it. The disease attacks the fastest-growing animals first; if the muscles of the heart are affected, the kid may suddenly die in the act of playing around. If skeletal muscles are involved more severely, the kid will move stiffly, rest often and generally lack 'tone'. The shoulder girdle may become loose and the toes splay, in long-

standing cases. Kids born with a deficiency may die within 2-3 days (selenium deficiency will also affect the doe, by contributing to retained placenta).

Consult your veterinarian or nutritionist to determine if your feed is deficient in selenium. If it is, be sure the animals receive supplementation either in their concentrate ration or in the salt-mineral mix. Many commercial mixes do not contain enough selenium to counteract a shortage in the feed; your veterinarian may wish to prescribe additional treatment. It is especially important that does in late pregnancy and newborn and growing kids receive enough selenium and/or vitamin E to prevent complications.

FOUNDER An inflammation of the tissues of the hoof, founder usually follows grain overload, metritis or acute mastitis. In the early stages, the foot feels hot, and lameness is evident and painful. Treatment of the primary cause, or the removal of excess grain, may help alleviate some of the damage; standing the goat in cold running water may also be useful. Following the acute stage, hooves often grow abnormally fast, becoming malformed with much elongation of the foot and thickening of the hoof wall into ridges. Trim hooves frequently until the condition finally grows out, if it ever does.

FOOTROT This infectious lameness is caused by a combination of bacteria entering the foot through skin damaged by scratches and constant exposure to wetness or frostbite. The skin between the claws of the hoof is affected first, becoming irritated and raw-looking. Later the infection invades the soft tissue next to the hoof wall, creating pockets of decaying material and separating the horny part of the hoof from the foot.

In most animals, footrot causes severe lameness. Many may carry the disease without showing symptoms, particularly if hooves are overgrown, trapping infectious material between hoof and foot. To keep this disease out of your herd, examine and trim the feet of any new additions thoroughly before you admit them. If you suspect infection, dip the feet in copper sulfate or zinc sulfate solution, or paint them with a commercial preparation. When trimming feet, all pockets must be dug out and exposed to the air to check for infection.

Footrot in the herd makes it necessary to trim every foot, separate affected animals and begin vigorous treatments with foot baths and systemic antibiotics. Some producers feel that feeding the goats high-iodide salt will help fight an outbreak, but field trials have been inconclusive. It helps, however, to see that the animal's diet contains enough zinc to prevent the initial lesions through which the infection enters the animal.

Clostridial infections

Goats are susceptible to clostridia that cause malignant edema, tetanus and enterotoxemia types C and D. Clostridia live in the goats' environment at all times, but under certain conditions will multiply rapidly and produce toxins.

Multiple clostridial vaccines may prevent this group of diseases and should be used regularly. Even though goats are not susceptible to some of the diseases these vaccines prevent, no harm will be done by using them. Kids under 10 weeks old cannot develop adequate immunity through vaccination, but they can receive it through their dam if she is immunized 4-6 weeks before kidding. If she has not been thoroughly immunized before that, she will need two vaccinations, one 8-10 weeks before kidding, and a second 4 weeks later. Any animal that has not been vaccinated, and kids born to non-immunized does, must be treated in this way for good immunity to develop. Give booster shots at 6-month intervals. In addition, practice sanitary management and controlled feeding to help reduce the incidence of infection.

MALIGNANT EDEMA Infection usually takes place when *Clostridium septicum* enters through contaminated wounds (such as from castration) or by unsanitary injections, kidding in dirty conditions, or even through teat orifices, especially if the udder is chilled and bedding is damp. Goats may die within 24-48 hours of the onset of symptoms. They exhibit lack of appetite, dizziness and fever; the sites of injury swell markedly, and the swelling spreads rapidly. If you spot the symptoms early, massive doses of antibiotics may help, but the disease is usually fatal.

TETANUS Ten to 14 days (occasionally several weeks) following a deep puncture wound that has not been opened and cleaned thoroughly, a goat may develop symptoms of tetanus from *Cl. tetani*; stiffness, muscle spasms, rapid heartrate and unusual alertness progress to rigidity and inability to chew or swallow. Round-the-clock nursing and antitoxins have saved some animals.

ENTEROTOXEMIA (Type C or D) Caused by *Cl. perfringens* types C and D, death is often the first symptom you see, particularly in young animals. Adults with Type D enterotoxemia may linger, suffering from diarrhea and incoordination, then die in several weeks. Kids may go off feed, sometimes have diarrhea, and die with convulsions a day or two later. Overfeeding milk to kids or grain to kids or adults will usually increase their susceptibility.

Pasteurella diseases

Pasteurella organisms cause many diseases. The section on respiratory diseases discusses

shipping fever; the organism *Pasteurella haemolytica* is responsible for others such as mastitis, arthritis and meningitis. It also causes a type of septicemia with symptoms very similar to enterotoxemia in that the young animals in the best condition are most often affected, and sudden death is common. This disease also follows the introduction of a high level of nutrition. The animals that do not die immediately display fever, shallow breathing and frothy discharge from the mouth. They frequently stand motionless, heads hanging. Antibiotics give varying success. Prevention is the best approach; always make ration changes as gradually as possible so the plane of nutrition never rises too suddenly.

Mycoplasma infections

Mycoplasma spp. also cause many problems for livestock. Pneumonia may be the first sign, but recovered animals can develop arthritis, be subject to abortions and freshen with a devastatingly contagious form of mastitis. Young animals become infected by drinking infected raw milk. Milkers become infected if teat cups or the milker's hands get contaminated by a carrier milked earlier. Airborne transmission is possible, and kids may be infected in the womb.

A herd that has shown no previous signs may become infected upon the introduction of a carrier animal, usually a milker shedding the organism from time to time in her milk. Stress usually starts mycoplasma shedding from the udder, so the best time to culture milk to find out if these germs are present is within a few days of freshening.

Kids fed from a general pool of raw milk may become infected by only one shedding doe. Swelling and heat in the joints of the legs, fever over 41°C and death follow. Respiratory symptoms are also common.

Prevent mycoplasmas from gaining a foothold in your herd by testing the milk of new does within 2 days of their arrival. Until you are sure they are clean, milk them last. Never feed raw milk to kids you aren't prepared to lose. Cull known carriers where possible; otherwise separate them and use extra care to prevent cross-contamination. Have your veterinarian aspirate any swollen joints and have the fluid cultured.

Mastitis

Kidding problems (metritis, retained placenta) often precede mastitis. The mammary system in early lactation is under considerable stress, and the doe needs a healthy immune system to protect her from infection. Milk is an ideal medium for the growth of many microorganisms. Some, like *Streptococcus agalactia*, reside in the milk and on the inner surfaces of the udder, where they cause damage. Others, like

Staphylococcus spp., colonize the tissues of the udder itself and may cause severe or chronic, low-grade, persistent infections. A third group, such as *E. coli* and *Klebsiella* spp., multiply rapidly in milk with low leucocyte count, causing inflammation that releases potent toxins into the goat's system.

You must find out exactly which organism you are dealing with in any case of mastitis. As soon as you notice symptoms but before beginning treatment, take a sample from each side of the udder. Disinfect each teat orifice with alcohol and allow to dry. Partly milk out the udder half, then fill a STERILE sample jar (a boiled babyfood jar will do – don't forget to sterilize the cover) without allowing any contact with dust, hair or your hands. Cover this immediately, to prevent adulteration, and deliver it to a laboratory. The laboratory will test to find which antibiotics will be most effective. Your veterinarian will help you interpret the test results and determine the proper course of treatment.

Mastitis often starts with the production of abnormal milk. Small flakes in a slightly watery fluid may become chunky, cheesy, often bloody clots in whey, or with *E. coli* infections, a brown, watery, evil-smelling fluid with white granules. With streptococcus and acute staphylococcus infections, the udder becomes hot and painful; with *E. coli* infections, fever may be transitory with the udder first noticed to be cold and hard. If the disease is unchecked, the goat will become seriously ill with fever, depression and gangrene of the udder.

Subacute mastitis is perhaps the most common udder infection, partly because it is so difficult to detect. Milk does not undergo any gross changes, although you may notice off-flavors. The goat shows little or no signs of illness, except for a possible decrease in production. The California Mastitis Test (CMT) or electronic somatic cell count detect greater numbers of somatic cells in the milk, which could indicate infection. Higher cell counts show up at the beginning and toward the end of a lactation, so tests should be regular to allow correct interpretation. A high cell count would justify culturing milk samples for organisms – *Staphylococcus* spp. most commonly causes chronic subacute infections.

While immediate treatment with a broad-spectrum antibiotic is called for when symptoms are noticed, remember that the milk samples you send off may indicate that this treatment is ineffective against the particular organism. In cases of chronic mastitis, in fact, treatment may not work at all until the doe is dried off and dry treatment substituted. In acute cases, however, and particularly if the goat shows illness, any treatment is better than none. Systemic antibiotics (by injection) as well as intramammary infusions will help fight the disease.

If infusing antibiotics into the udder via the teat orifice, practice strict hygiene to prevent introducing antibiotic-resistant organisms to the udder. Don't take shortcuts – follow instructions to the letter to avoid contamination of the orifice, the cannula and the solution itself.

Other diseases

RINGWORM A fungal disease of the skin, ringworm often appears as coin-sized circular patches, especially about the head and face. Other forms may be less easy to diagnose, producing areas of dry, scaly skin where hair tends to fall out. Damp, dirty housing can lead to this condition, so if symptoms appear it's definitely time to clean the barn. Often this cleanup, with dry fresh bedding, will stop an outbreak in the herd. If the disease has been around for some time, you will have to disinfect the barn's walls, feeders and partitions with Captan or a similar product – use heavy scrubbing or a high-pressure sprayer for best effect. Also, delouse the herd in case lice are spreading the disease. Vitamin A supplements may also be required.

Treat individual cases by brushing off the scaly crust from ringworm sores and applying tincture of iodine or other fungicide preparation. To keep the area from itching, mix iodine with glycerine to soften the skin; whatever remedy you use, apply it every 1-2 days until the condition is cured. During treatment, wear rubber gloves and protective clothing, since the organism can also live on people.

PINKEYE Affecting the eyes, pinkeye begins with the animal shedding excessive tears, followed by a clouding of the cornea; in later stages, a blister that can rupture may appear on the cornea. Mycoplasmas, chlamydia and especially rickettsias are possible causes. An affected goat is sensitive to light, and should be kept in a dark area while symptoms persist. Wind and dust most often lay the animal open to infection by drying and irritating its eye. Vitamin A insufficiency is usually a factor, as well.

Early treatment will help minimize the damage. Use only solutions and ointments recommended by your veterinarian. NEVER USE POWDER IN THE EYES. Powders irritate and cause the animal undue stress. If the problem persists, an injection of antibiotic directly under the cornea may hasten recovery. The condition is highly contagious and apparently airborne in some cases.

SOREMOUTH (orf) A virus causes this disease, which most often attacks young animals or those previously exposed. Certain strains are more virulent than others, and immunity to any strain may be imperfect after a year or so. The disease usually begins with blistering sores about the lips or nostrils. Sores grow and multiply, turn dry and

scab over. Finally, after 2-3 weeks, the scabs shrink and fall off, leaving hairless patches that disappear within a few days. There isn't much you can do except let the disease run its course, and prevent secondary bacterial infection by applying antiseptic solutions. The worst consequence of this disease may affect a doe nursing an infected kid. If her immunity is weak, she will develop the sores on her teats and udder, and mastitis can result. The disease is highly contagious, so if you notice one infected kid, pull all the kids off the does and either wean them or feed them from a bottle or pan. Incidentally, humans can develop these sores from contact with sores or scabs, so protect yourself with rubber gloves as well as you can.

You can buy a vaccine for soremouth that may give immunity to some strains. Another vaccine may be prepared by mashing up the scabs from an early case in a little distilled water, then using this solution in the same way as the commercial vaccine: scrape raw a tiny patch of bare skin, then brush the solution onto the area. The inside of the ear is one place used to vaccinate goats this way; the underside of the tail is another. A sore will develop on the area, and will be as contagious as the disease itself, but hopefully will not reach the mouth and will give immunity. If preparing kids in the spring for a show, keep in mind that you should vaccinate them at least 6 weeks before, because they need an incubation period of 10 days to 2 weeks, plus an infective period of 3 weeks, plus an additional week for good measure.

Although animals are not allowed into shows when they have soremouth, they still might become infected by goats outside their herd, so vaccinate to avoid problems.

ABSCESSSES There are several reasons an abscess forms in an animal – foreign matter such as a sliver or a deep bruise will attract white blood cells to the area and pus may form, even in the absence of bacteria. A sample of the abscess contents will reveal little or no infective agents such as staphylococcus or streptococcus.

Whenever an abscess appears in one of your animals, have a sample of its contents analyzed for *Corynebacterium pseudotuberculosis*, also known as *Corynebacterium ovis*. This bacterium causes recurrent abscesses of the lymph glands in particular, and may lead to wasting away and the death of severely affected animals. Typically, the material inside this type of abscess is greenish-white and odorless. As the abscess matures, the pus becomes dry and 'cheesy'.

Caseous lymphadenitis is the name of the disease caused by this bacterium. The organism settles in the lymph gland, and groups of these bacteria clump together, surrounding themselves

with an almost impenetrable mucous membrane. As the colony grows, the capsule that encloses it becomes more fibrous still. Antibiotics cannot penetrate the abscess wall. In the normal course of the disease, the abscess grows to a certain size (which varies) and the capsule becomes thinner in one area. If this is on the outside, the hair comes loose before the abscess actually opens up and the contents drain. If the abscess drains toward the inside of the goat, the lump simply appears to go away, but in reality the infectious pus continues to spread the infection throughout the body. The spaces between the lungs and heart, the lymphatic and connective tissue around the intestines, the liver and even joint capsules may become infected with multiple abscesses. The goat afflicted with many internal abscesses may pass infectious material in the feces or even by coughing.

A herd that has never shown any sign of this disease may become infected by an animal introduced from an infected herd, whether or not it shows signs of having or having had abscesses. Some goats seem to have more immunity than others, and a few will develop one abscess without ever getting another.

The possibility of infection may also be affected by your herd management and the degree of infection the animals are exposed to. If you completely isolate new cases from the herd before abscesses burst, it lessens the danger to the other goats.

If possible, remove the abscess whole before it opens on its own. If already opened, drain the abscess, scrape the inner surface of the capsule clean and thoroughly flush the cavity with antiseptic solution. Then sterilize the cavity with alcohol or tincture of iodine and dry it. Don't let the animal back in with the herd until the lesion heals completely. If a second abscess develops, seriously consider culling the animal, lest it become a focus of infection for the herd. If several animals are affected at once, the possibilities of retaining any control over the disease diminish drastically.

The pus from a caseous abscess carries the bacterium and protects it from drying and from exposure to sunlight, both of which can inactivate it. If you must use pens that you suspect have been infected, high-pressure spraying of all surfaces with a moderately strong antiseptic solution followed by thorough drying will give a good degree of safety.

An encouraging new vaccine combines a caseous lymphadenitis vaccine with several clostridial vaccines. Kids vaccinated twice before they are a year old seem to be more resistant to infection. You must get this vaccine through your veterinarian and management remains important to the success of the program.

Corynebacterium pyogenes is closely related to the bacterium that causes caseous lymphadenitis. This organism is almost as hard to dislodge as its brother, but infection almost always starts through some prior damage. Frostbite, a wound or similar mechanical trauma will allow its entry to cause mastitis, a necrotic laryngitis or footrot. The pus from these abscesses is relatively liquid and yellowish; treatment with systemic antibiotics is usually ineffective.

Prevent entry of this organism by guarding teats from frostbite, protecting goats from injury by sharp objects or barbed wire and by treating all wounds, even scratches, with antiseptic as soon as possible.

A cyst may look similar to an abscess, but is usually filled with a clear liquid. Salivary ducts are common places for cysts to form; they are annoying but not contagious.

JOHNE'S DISEASE Because of its long incubation period, symptoms don't usually appear until the animal is over 2-3 years old. The manure carries the infection long before symptoms become evident. Kids under 6 months old are most susceptible. The organism, a mycobacterium, can live in manure and contaminated soil for more than a year.

Diagnosis is very difficult and almost impossible before clinical signs appear. The affected animal wastes away, loses condition and lowers its production, in spite of eating well. During the last week, it develops diarrhea and dies. Post-mortem examination reveals a characteristic thickening and folding of the small intestine's wall, which has prevented the absorption of nutrients. The organism may be cultured from tissue samples from the affected area.

Once you know a herd has infected individuals, you can take some steps to reduce spread of the disease. You must remove kids at birth and raise them without allowing contact with adult fecal matter. If new animals frequently enter the herd from sources not known to be Johne's-free, raising kids in this manner may help prevent future problems. By also minimizing the quantity of manure to which all of the animals are exposed, you help control the spread of several other diseases as well.

LISTERIOSIS When a pregnant doe contracts this disease, she is likely to abort. The bacterium probably gains entry through the mouth; a particular lot of silage may seem to produce cases of listeriosis and, when changed, new cases don't occur. Lice may also transmit the germ. If a doe aborts, have the placenta and fetus cultured to determine if it contains the organism, which may also be found in her milk for several months. Humans may contract this disease, with miscarriages or meningitis the result.

Listeriosis in a non-pregnant goat takes the form of an encephalitis, with fever, incoordination and lack of appetite. The goat stands off by itself, in a corner usually, and leans against the wall. It may drool, and often one or both ears will droop; the muscles of the head and neck seem especially tense. The disease is sometimes called 'circling disease', because in many cases the animal will stagger around in a circle in one direction. If you begin treatment early with large doses of antibiotic, the animal may be saved.

An outbreak of listeriosis is most likely to occur in late winter or early spring; a period of warmer weather followed by a drop in temperature may have occurred within the previous week. Isolate affected animals immediately.

CHLAMYDIAL ABORTION AND VIBRIOSIS These two diseases produce almost identical symptoms. Abortion occurs during the last 2 months of pregnancy with little or no warning. First fresheners and previously unexposed does are at highest risk.

Laboratory diagnosis of the fetus and placenta will differentiate between the two organisms. Vaccines are available to prevent outbreaks in subsequent seasons, and you may have some success controlling outbreaks by feeding antibiotics during the last weeks of pregnancy. There is no evidence that the buck can carry either disease, but the discharge and fetal membranes from aborting does are very infective; doe kids may become infected at birth or shortly after by nibbling contaminated bedding, yet not show any illness until their first pregnancy.

TOXOPLASMOSIS The protozoan parasite that causes this disease is commonly carried by cats, and is shed intermittently in their feces, where it may survive for months. Strong iodine or ammonia solutions will kill it. In adult goats, symptoms such as mild incoordination may last only a few days; occasionally they get diarrhea. If a doe is in late pregnancy, however, the parasite will localize in the uterus, causing abortion or the birth of weak kids. Following infection, the doe will pass the organism in her milk for an indefinite period. Humans may become infected from drinking this milk unpasteurized, leading to abortions and birth defects.

METRITIS An infection of the uterus often follows abortion or difficult kidding, especially if placenta is wholly or partially retained. Even normal kidding under unsanitary conditions can permit disease organisms into the reproductive tract. The organisms that cause metritis may be any of numerous types that live in the goat's environment, which invade an animal weakened by trauma or malnutrition.

Symptoms of a general illness may appear 1-3 weeks after kidding. The doe goes off feed, becomes depressed and develops a fever over 40°C. If untreated, the condition may become chronic; the doe will recover (apparently completely) but the uterus will thicken and fill with pus. The cervix may become impenetrable, making surgery the only way to get antibiotics into the uterus. At this stage, however, even surgery rarely succeeds.

Prevention begins with proper nutrition. In particular, does must receive enough selenium to prevent retained placenta. If you see a doe kidding or aborting, isolate her in a clean area. If she doesn't expell the placenta within 4 hours of the kids' birth, consider giving her one injection of either oxytocin or prostaglandin – either will encourage contractions of the uterus.

A healthy doe has a good chance of fighting off infection without regular administrations of antibiotics and decomposition may be confined to placental material alone. On the other hand, a doe in poor condition or suffering exhaustion or disease may be unable to withstand the invasion of uterine tissue by pathogenic organisms, and would benefit from antibiotics shortly after kidding. Certainly, if she begins to show signs of systemic infection, treat her immediately as recommended by your veterinarian.

Diseases that endanger humans

Humans can contract many animal diseases. In the case of dairy animals, their chief danger is from disease-carrying milk. While some of the classic milk-borne diseases (tuberculosis, brucellosis) are extremely rare in North America, goats' milk may contain other organisms even if no-one suspects the animal is sick. The following includes some that have been mentioned earlier, but are repeated for emphasis:

LISTERIOSIS This disease may cause abortions, miscarriages or meningitis in humans.

Q FEVER Although this causes minimal illness in goats, it can be passed to humans in milk or fetal fluids. People may suffer fever and influenza-like symptoms, and infants or heart patients may die.

TOXOPLASMOSIS Shed intermittently in the milk of carriers, this protozoan parasite localizes in the uterus of pregnant women and causes birth defects or miscarriages. Infected infants may become blind after birth.

SALMONELLOSIS Unpasteurized milk definitely ranks as a major source of infection. Salmonella can also contaminate milk from the air. Gastrointestinal symptoms, including diarrhea, can be severe, especially in the very young or very old.

GASTROINTESTINAL DISEASES Yersiniosis, shigellosis and campylobacteriosis may also be carried by unpasteurized milk.

OTHER BREEDS

Angora

The Angora is bred for its hair (mohair), one of the most valuable fibers produced in this country. Smaller than dairy goats, Angoras weigh between 27-45 kg at maturity. These horned animals are sturdy but not coarse. They should be pure white, but 'freckles' are tolerated on the ears and nose. The horns should be left intact for grooming and defence.

The hair should cover the body completely – with the ears, eyes, nose and mouth being the only areas free of fleece. Ideally, the hair will be uniform in length and quality and yield about 5-7 kg each year. Generally, the fiber from younger animals is finer and therefore more valuable for trade. By the time the animal reaches 8 years of age, the quality of its mohair has diminished.

Management differs somewhat from that of dairy goats. The fleece demands special care if it is to be valuable. Like sheep, these animals have particular needs because of their dense fleece and occasionally suffer from problems not common to other goats.

Pygmy and Nigerian Dwarf

The Dwarfs look like miniature dairy goats. They have erect ears and a straight face, and can be any color combination. To be eligible for registry in Canada, they must not be 'polled' and cannot be more than 58 cm high at the withers for bucks and 55.5 cm for females.

The Pygmy goat is a blocky, well-muscled animal with a shorter neck and cannon bones (lower portion of legs). It must have erect ears and be born horned. It must also have a dished face and specific color markings, though various shades are allowed. Standard markings are muzzle, forehead, eyes and ears of all colors, except those that are black, white or caramel. Animals whose basic body color is not dark must have dark front dorsal stripe, rear hooves and cannons (socks), crown, dorsal stripe and martingale. For caramel and white 'Agouti' goats, light vertical stripes on dark socks are acceptable; all other patches are seriously faulted but do not disqualify the animal from registry. This breed also must meet the same maximum size standard as Dwarfs.

Both miniature breeds are primarily kept as pet stock. They may be found in petting zoos, but usually are the center of attention on small farms where children want affectionate, easily maintained livestock.

For more information

If you'd like additional information on these breeds, write the Canadian Goat Society. You

can obtain the society's current address from Communications Branch, Agriculture Canada, Ottawa K1A 0C7, telephone (613) 995-5222.

