

Llamas

101

(an introduction into the versatility of llamas)



Llama Facts for New Owners

Welcome to the fascinating world of llamas!

If you have recently purchased or are thinking of acquiring your first llama, you are joining a rapidly growing group of llama enthusiasts around the world. Llamas are delightful animals with a unique history. Though they share a number of characteristics with more familiar livestock, they have some very special attributes. This review of the important facts about llamas will acquaint you with your new family member.

Heritage

Llamas are members of the camel (Camelid) family. In addition to the well-known, one-humped Dromedary camel of the Middle East and the two-humped Bactrian camel of Asia, there are four native members of the camel family in the Americas today: the **llama**, a domesticated beast of burden regarded throughout the world as the premier symbol of South American animals; the domesticated **alpaca**, selectively bred for its fine, multi-hued wool; the free-ranging **guanaco**, probable progenitor of the llama and historically common herbivore of the arid lands of South America; and the wild **vicuna** fine-fleeced denizen of the central high Andean mountains.

The term *Lama* (with one L) is used here to refer to all four South American members of the Camelid family and the word *Llama* is used in reference to that particular species. Though less common, the terms *cameloid* or *lamoid* may sometimes be used to indicate this group. While this brochure refers mainly to the llama most of what is said applies equally well to the growing number of alpacas in North America.

Llamas and their relatives are no strangers to our land. The camel family originated on the central plains of North America and spent their first 40 million years right here in our own backyard! Then, some three million years ago, camels migrated to Asia and Africa, while Llama-like animals dispersed to South America. Just 10,000- 12,000 years ago, at the end of the last ice age, the camelids became extinct in North America. Meanwhile, in the highlands of Peru, some 4,000-5,000 years ago, llamas were domesticated, placing them among the oldest domestic animals in the world. In the late 1800s and early 1900s, private animal collectors and zoos reintroduced them to their original North American homeland. Today there are an estimated seven million llamas and alpacas in South America (in approximately equal numbers) and some 100,000 llamas and 5,300-5,700 alpacas in the United States and Canada.

Buying and Value

If you are looking for a pack animal, wool producer or pet that is easy to care for, llamas are the answer. You will generally find that females are more expensive than males. Prices vary depending upon age, health, size, wool, color, conformation and use.

Llamas are by far one of the easiest to care for of any domestic livestock, and are an investment the entire family will enjoy.

Before you buy your llama, visit with and talk to as many llama owners as possible. Base your final selection on the animal(s) that most appeal to your interests as an owner or breeder. Be sure to ask the previous owner for the International Llama Registry (ILR) certificate, or date of birth and the names of its sire and dam. Contact ILR if you have questions regarding registration.

Characteristics

Whether viewed in a pasture or glimpsed in the wild, all *Lamas* have a striking beauty owing to their elegant wool and graceful posture. Llama and alpaca wool ranges from white to black, with shades of gray, brown, red and roan in between. Markings can be in a variety of patterns from solid to spotted. Little variation is found in guanacos or vicunas that are light brown with white undersides.

Mature llamas weigh an average of 280-350 pounds, but range from 250-500 pounds. Full body size is reached by the fourth year, and, while there are no obvious differences between the sexes, males tend to be slightly larger. They are long lived, with a normal life span of 15-20 years.

Like cattle, sheep and deer, llamas are multi-stomached ruminants that chew their cud. They have a hard upper gum (no upper teeth in front), grinding upper and lower molars in back, and an ingenious upper lip for grasping forage in unison with the lower incisors. Adult males develop large, sharp upper and lower canines ("wolf teeth" or "fangs") for fighting. You should ask your veterinarian to remove these to prevent injury to males pastured together or to females being bred.

The llamas' unique, specially adapted foot makes them remarkably sure-footed on a variety of terrain, including sandy soils and snow. It is two-toed with a broad, leathery pad on the bottom and curved nails in front. The small, oblong, bare patches on the side of each rear leg are not vestigial toes ("chestnuts" as found on horses), but metatarsal scent glands, suspected to be associated with the production of alarm pheromones. An additional scent gland is located between the toes.

How old is your llama? Age can be determined reliably in young animals by checking the larger, permanent incisors that erupt to replace the "milk" or deciduous front teeth. The

middle pair of incisors (11) comes in between 2 and 2.5 years of age, and the second pair (12) at around three years of age.

Housing and Fencing

Simple but necessary preparations should be made before you bring your new family member home. Fencing can be woven wire, cattle wire panels, wooden rails or poles, chain link or electric. Barbed wire does work but is not recommended. Your fences should be at least four feet high and dog proof if possible. A three-sided shelter to provide shade and protection from extreme heat, cold, wind and rain should also be provided. If you have severe chill factors in winter, a completely enclosed shed is necessary. Heat stress should be a concern if you have hot, and especially humid, summers at which time a sprinkler, wading pool or small ponds are helpful. If your animals are kept in a large pasture, a small 12-20 foot square catch pen will make it easier to catch them. Feeding and watering troughs should be clean, high enough to be free of possible fecal contamination, and spacious enough to allow access by all animals. Fresh water should always be available. Shearing of long-fibered llamas and alpacas is recommended in excessively hot climates.

Transportation

Llamas are easy to transport and require no specialized equipment. A covered, wind-proof pickup, van, horse or utility trailer with sufficient room for animal(s) to stand comfortably works well. Good ventilation is important in both summer and winter. Straw makes excellent bedding in a wind-proof enclosure, and be sure to provide hay for food and offer water free choice at least every 6 hours depending on heat (it will spill if left with the animals). Llamas normally lie down once the vehicle starts moving. If transporting babies and mothers on long hauls, stop periodically to allow nursing.

If your new Llama is coming from out-of-state, check at least four weeks in advance to see if your state requires a veterinarian-issued health certificate. A permit number and/or tests for brucellosis, tuberculosis, and other diseases may also be required. Some states may require permanent identification markings on the animals. Full mortality and/or broad named peril (including transportation) insurance is available.

Care and Feeding

If you are familiar with the care of other domestic livestock, you will find llamas comparatively easy to maintain, with a minimum of veterinary assistance required. If you are uncertain of the health of your new animal, consider isolating it in sight of, but separate from your other animals for the first two weeks to prevent accidental introduction of any illnesses, and to give you both a chance to get acquainted. Make sure it is eating and ruminating, as well as eliminating pelleted feces. If you have not already done so, this is the time to locate a veterinarian in your area. If he or she is inexperienced with

Llamas, information is available through national associations to handle problems that may arise. It is recommended that you have your veterinarian give your newcomer a general health check, and take a fecal sample to determine if worming is necessary.

Although llamas have long been arid land dwellers, they thrive in the wide array of temperate environments throughout the United States and Canada, including Alaska. They are highly adaptable feeders, being both grazers (grasses and forbs) and browsers (shrubs and trees). Because of a relatively low protein requirement due to their efficient digestive systems, they can be kept on a variety of pastures or hay. They eat about 2 percent to 4 percent of their body weight in dry matter every day. Without pasture, a 100 pound bale of hay will last an adult llama around ten days...good news, indeed, to experienced horse and cattle owners! If you're going to graze your llamas, plan on about three to five animals per acre on a moderate-producing pasture.

When good hay is available, grain is recommended only for working pack animals and nursing females. Sheep mineral and salt blocks (with selenium wherever necessary) should be available free choice. Granulated minerals are somewhat more wasteful than mineral blocks, but are easier to eat since llamas can't lick. High-protein grain mixes prepared for other livestock should generally not be given to a healthy llama on a good diet, unless it's a female nursing or close to giving birth. Llamas are not prone to bloat, but have been known to do so if they get into a grain bin. Avoid over feeding llamas.

Llamas require less water than most domestic animals, but should have an unlimited, fresh, clean supply at all times. They tend to drink less in winter and when on lush, green pasture, and more when working or lactating, especially in summer.

Unless your llamas are pastured on hard or rocky ground, you may have to trim their toenails once or twice a year. It's easy to do yourself with horse hoof trimmers or sheep toenail nippers, but consult available literature or your veterinarian before your first attempt. Llamas are amazingly hardy animals and have very few problems with disease. But to ensure good health you should establish a regular schedule for cleaning their dung piles, and a preventative medicine program which may include protection from enterotoxemia, tetanus, leptospirosis, and internal and external parasites. They should be dewormed at least every six months. Be sure to check with your veterinarian or agricultural extension agent to see if any vital trace elements or minerals are deficient or present in toxic amounts in your area. Consult your veterinarian or for other preventative medical suggestions, or to see if any special circumstances (e.g. meningeal worm, selenium levels, toxic plants, etc.) are problems in your area.

Habits and Behavior

Llamas have a dignified, aristocratic manner about them. Because of their curiosity, they have a delightful habit of coming close to sniff strangers. But despite your natural

temptation to hug and cuddle them, they prefer not to be petted except on their necks and woolly backs. You need have no fear of children around them, as they are gentle and don't spook easily, and rarely bite or kick unless provoked. They are highly social animals and need the companionship of another llama or other grazing livestock.

Llamas communicate their moods with a series of tail, body and ear postures, and vocalizations. Learning this llama language is one of the joys of ownership. Humming is a common manner of communication between llamas, and indicates a variety of moods from contentedness to aggression. Another interesting llama expression is the shrill, rhythmic alarm call emitted at the sight of a strange animal (especially dogs) or a frightening situation. Spitting, usually related to food disputes, is seldom directed at people unless a llama has been mishandled or become imprinted on people through bottle feeding as a baby. As with bottle-fed stallions, bulls and rams, bottle-fed male llamas who have not been gelded at an early age can be dangerous as adults, because they lack a normal fear of people and regard them as competitors.

Llamas are remarkably clean, and even large herds are quite odorless. Dung-piling behavior is an important means of spatial orientation and territorial marking for these historically open habitat animals, and a convenience when you clean their pens. By taking advantage of this habit you can encourage your animals to establish dung piles in a new pen by "prebaiting" four to five sites per acre with a shovel full of Llama pellets. You may frequently see your llama rolling in the dirt, taking a dust bath to help maintain a healthy, fluffy coat of wool.

Breeding and Reproduction

Female llamas are good mothers and there is nothing as delightful as the sight of their babies playing and romping. Though females have been known to conceive as early as four to six months, they should not be bred until 18-24 months depending on size and development. While males may be fertile at seven to nine months, they aren't fully dependable breeders until three years old when they are socially and sexually mature. Llamas breed in a prone position (male on top), and copulation may take up to 45 minutes. The act of copulation induces ovulation (i.e. they ovulate 24-36 hours after mating). Gestation averages 350 days and a single offspring is produced; twinning is rare. The average weight of a normal newborn llama is 25-30 pounds, but can range from 18-40 pounds.

Because they are induced ovulators, llamas can give birth throughout the year. Depending on your climate, you should plan breeding to avoid births in the extreme heat of summer and cold of winter. Births normally occur in the daytime. From the onset of normal presentation (of both feet and head) to birth, 10-45 minutes may elapse. Unlike most mammals llama mothers do not lick their newborn nor eat the afterbirth. Llama young, called "crias" in South America, begin walking within an hour and should nurse in one to two

hours. The placenta is usually passed within four hours. Females are normally bred back three to four weeks after giving birth, and pregnancy can be determined 21 days or more after breeding through an inexpensive laboratory test for progesterone from a small blood sample. Another indication of pregnancy is the female's refusal to breed when reintroduced to the sire.

Llamas, guanacos, alpacas and vicunas can interbreed and should therefore be pastured separately. Males not intended for breeding are gelded at about two years of age, and males which have had to be bottle-fed must be gelded as early as possible, to avoid abnormal behavior. Geldings can make wonderful, affectionate pets.

Uses and Training

"What are they used for" is a question commonly asked of llama owners. Breeding, packing, wool production, companion animals and sheep guarding head the list of common llama uses. Because they are so gentle and easy to train, llamas are popular attractions in parades, shows, fairs and community events, and are fun to take on school, hospital or nursing home visits. Llamas and guanacos are becoming increasingly popular for guarding sheep from coyotes.

The Llamas' centuries-old ability as a beast of burden has been rediscovered by hikers, hunters and forest work crews in North America. Their hardiness, surefootedness and common sense make them an excellent pack animal and trail companion. They are quiet, unobtrusive and so easy to manage that children love to lead them. Their great agility allows them to negotiate terrain that would be difficult or impossible for traditional pack animals, and, because of their padded feet and ability to browse, they have minimal impact on the backcountry. When confronted by other pack stock, unexpected situations, and sudden movement or noises, llamas remain calm and unruffled. Males are most commonly used for packing, and, depending on maturity, weight and condition, will tote 50-120 pound packs 6-15 miles a day. An animal's performance is always relative to training, fitness and trail condition. A variety of custom packs and halters are available for llama use.

Camelid (especially alpaca) wool production is a multimillion dollar industry in South America, making these animals appealing to spinners and weavers here. Llamas have soft, fine wool, for protection against cold and insulation from heat, which can be made into beautiful garments and blankets. Llamas hand-shorn every other year will produce a grease-free fleece weighing three to eight pounds with a fiber length of four to seven inches. Year-round brushing yields about the same results and leaves the long, coarser guard hairs in place.

Their docile nature makes llamas extremely easy to train to accept a halter, lead, kush (lie down), carry a pack, load in and out of a vehicle, pull a cart or carry a lightweight rider. With just a few repetitions they will pick up and retain any of these skills.

Llamas with minimum training are easy to handle when you are trimming nails, brushing or shearing, or when health problems necessitate touching them in sensitive places.

Feeding Camelids

While the following is particularly directed at the Llama, most is applicable to the alpaca and other members of the genus *Lama*. In their native environs, the alpaca shows a grazing preference toward moist lush forages, while Llamas will tend to prefer more coarse dry vegetation, being more of "cafeteria style" eaters.

Llamas are much easier to feed and care for than most livestock. Because they are grazers of both grass and forbs and browsers of shrubs and trees, they are much more flexible in their choice of diet. Llamas, like other South American camelids (SAC), are more efficient at converting plant material into usable protein and energy than sheep and cattle, and are less prone to medical problems associated with feeding, such as bloat and grain overload (acidosis).

As a practicing/teaching veterinarian, the author's nutritional recommendations are aimed at the overall long-term health of Llamas. Because they are more efficient at converting plant material to usable energy, Llamas may easily become over-conditioned through excessive feeding. Llamas in their natural environment do not routinely carry the abundance of fat that many North American Llamas are currently doing, a situation which should be avoided. Over-fed Llamas are often difficult to breed, having more problems in conception, delivery and lactation. In addition, their total life span is likely compromised.

Basic SAC Digestive Anatomy and Physiology

All living creatures ingest their food, digest it by various means, absorb the majority and excrete the balance. The Llama is a modified ruminant herbivore that ingests plant material and digests it in a unique, three-compartment stomach. The Llama's stomach is functionally similar but anatomically different from that of true ruminants (cattle, sheep and goats). The first compartment is essentially a huge fermentation vat which, through enzymatic and microbial processes, enables separation of plant material into readily digestible basic nutrients and semi-digestible cellulose.

The basic nutrients (proteins, fats and carbohydrates) are either absorbed directly or further broken down into simple sugars, amino acids or fatty acids. Cellulose is utilized by bacteria and protozoa in the fermentation vat to replicate their vast numbers. The resultant microbial protein is then digested.

Beyond the stomach, Llamas are not notably unique in their digestive anatomy and physiology, however the relatively slow gastrointestinal transit time, efficient water absorption and pelleted feces all contribute to digestive superiority.

General Llama Nutrition

All feedstuffs yield variable amounts of carbohydrates (energy), proteins, fats, minerals and vitamins. The Llama's requirement for these is influenced by age, demands for resting body maintenance, anticipated growth, activity, workload, state of pregnancy, lactation and environmental temperature. Providing optimum energy and protein is the basis for any Llama feeding program. Like most herbivores, Llamas are limited to an absolute maximum daily dry matter intake. For the Llama, this figure appears to be 1.8-2.0% of body weight.

Energy

Forage (pasture and hay or browse) should be a major contributor of energy to the diet. For certain circumstances, cereal grains (corn, oats, barley, etc.) may be used as supplemental high energy sources.

Energy requirements vary according to body size. In general, feeding efficiency for body maintenance increases with animal size. Metabolism studies at Colorado State University have determined that the maintenance energy requirement for Llamas is 84.5 Kcal/BW.75 (kg). Energy content of common feedstuffs have been or can be readily determined by analysis. Using examples of animals weighing 110 lb (55 kg), 220 lb (100 kg) and 330 lb (150 kg) one can appreciate that efficiency of body energy maintenance increases with body size. Of particular note is the fact that springtime pastures are extremely high in energy content. Unless animals are growing, in late gestation, early lactation, extremely athletic, or exposed to prolonged cold temperatures, they should not be allowed free choice access to quality forages, or be supplemented with concentrates.

Protein

The Llama's protein requirement is relatively low. Protein in adequate quantity and quality is necessary to replace aging body proteins and produce new protein for muscle, fiber and milk. Because Llamas have an exceptional ability to recycle and utilize urea (the major by-product of normal protein breakdown in the body), they can do extremely well on a maintenance diet of 8 to 10% crude protein. Growing weanlings, advanced pregnant and nursing mothers require a 10 to 12% protein ration. A baby who must be weaned early for some reason will benefit from a 16% protein ration, gradually reduced to 12% by six months of age to maturity.

In most cases, quality grass hays will suffice to provide adequate protein intake. When protein supplementation is deemed necessary, incorporation of alfalfa hay (up to 1/3 of the forage ration) will be adequate. The advantage of staying with an all-forage diet lies

principally in that crude fiber in the total diet will not be markedly reduced. It is important not to exceed 1/3 of the total diet in alfalfa so as to not be feeding excessive protein as well as to prevent excessive intake of calcium relative to phosphorus.

Bear in mind that protein content of pasture and browse vary with the season. In spring, when plants are actively growing, protein content and quality is greater than at maturity. Again, be cautious about overfeeding protein as it is wasteful for the owner and a metabolic burden to the animal. While no feeding trials have to date been performed, it is the author's opinion that using nonprotein nitrogen sources (urea or biuret) should not be considered.

Fiber As with conventional ruminants, the SAC have an important need for adequate fiber in their diet. At this point, it would appear that the total diet should be approximately 25% or more of crude fiber. Based on observations from conventional ruminant species, lack of adequate fiber reduces gastric performance and seems to have a correlation with gastric or duodenal ulcers. Forages in general are the principle source of fiber, with grains generally being deficient for providing the level deemed important in Llamas.

Water Ideally, fresh and clean water should be made available free choice at all times, however Llamas are relatively tolerant to a degree of water deprivation. On the trail, one good drink a day will suffice. Depending on activity, environmental temperature and feed (i.e. green pasture vs dry hay), daily intake varies from 5 to 8% of body weight (i.e. 2 to 3 gallons for a 300 lb Llama). Llamas may be reluctant to drink from unclean containers, including automatic watering cups.

Salt In most all management circumstances, loose salt should be offered free choice in a container sheltered from weather. Salt should be iodized except in areas where iodine deficiency is not known to occur. Trace mineralized salt is better than plain salt but should not to be considered as a mineral supplement. Combining salt with minerals has worked well to both encourage consumption as well as minimize over-consumption.

Calcium and Phosphorus A balanced daily intake of calcium and phosphorus is important, particularly to maximize growth of youngsters and for adult reproductive performance. The desired dietary balance of calcium:phosphorus normally is 1.2-2.0: 1, which is commonly found in many grass hays/pastures. Because need for mineral supplements varies with forage diet, forage analysis is ideal on which to base any specific mineral incorporation. A relatively simple, inexpensive mineral mix that meets the needs of most Llamas on grass pasture can be obtained. This mix is meant to be offered free choice, with no other supplements (mineral or salt) being available. While consumption of mineral mixes may initially be limited, most Llamas will generally consume up to 1 oz/animal/day.

Grass hay, cereal grain hays and cereal grains provide significant amounts of phosphorus unless they originate from phosphorusdeficient soils.

Some notes of caution Abnormal bone growth can result from deficiencies of calcium, phosphorus and vitamin D as well as imbalances of calcium to phosphorus. Excessive phosphorus intake may predispose animals, especially males, to urinary tract stones.

Vitamins Properly cured hay normally contains sufficient vitamins A, D and K but supplemental vitamin-mineral mixes can be offered to cover potential deficiencies. Research indicates that vitamin E is quickly lost in cured forages, making it necessary to supplement. It is believed that normal healthy Llamas synthesize adequate B vitamins during digestion.

Trace Minerals Whether deficient or excessive, selenium, zinc, magnesium, cobalt and copper are significant diet factors. It is imperative that you consult a local nutritionist, county agent or veterinarian to learn if specific supplementation or reduction of these nutrients is required in your area. For example, too much selenium in the diet can cause alkali disease and "blind staggers", while too little can cause white muscle disease or interference with growth, reproduction and lactation.

Feeding Recommendations

There are unlimited feeding options and combinations. Cost, local availability, and nutrient balance must all be considered in designing your own program. Forage analysis is the backbone of your feeding program.

Although Llamas appear to be quite adaptable to a wide range of feeding schedules, including free choice and once-a-day feedings, regularity is important. The following are some thoughts on the major options and considerations.

Hay Because of its high protein content and relative availability, alfalfa hay is a popular food consideration for Llamas. Keep in mind, however, that it is not the panacea forage for all Llamas. Cost may be excessive, and protein content certainly is, especially if it is overfed. For example, if the analysis of your alfalfa hay indicates a 16% protein content but your Llamas eat only the leaves because you are feeding too generously, in all likelihood their protein intake actually exceeds 24%. Reduce the portion so they will eat the less protein-rich stem as well. Better yet, consider feeding alfalfa as a supplement rather than the total forage intake. Quality oat hay, pea hay, fescue, brome, timothy, orchard grass, clover hay and even some straw are viable options. When buying hay, look for the following: Color - An interior bale color of pure green (most vitamin A, D and E have been destroyed in pale green to yellow hay).

Leafiness - Lots of leaves (that's where the protein is).

Moisture - Softness, palatability and digestibility are greatly influenced by moisture content. Improper curing results in excess moisture causing hay to mold within three weeks after baling. Ideal hay moisture content is 12% or less.

Smell - Look for that good "fresh" smell. Musty or moldy odors can spell problems.

Mold - Never feed moldy hay.

Dust - Avoid dusty hay but if there is no alternative, sprinkle flakes with water. Nutrient testing of your hay supplies is a good investment.

Pasture Pasture varies greatly from one area to the next, depending on climate and soil conditions. In addition, unless irrigated and fertilized it will vary tremendously during the growing season. Pastures and hay fields need to be fertilized occasionally.

Your county extension agent can advise you on how to do a soil analysis and fertilize your pasture. Timothy, brome or orchard grass with a little bluegrass, white clover, and/or alfalfa, makes a good Llama pasture. Free choice pasture allowing maximum dry matter intake may well be excessive nutrition for most of your Llamas.

Complete Rations Some Llama owners choose to feed commercially prepared, completely formulated pelleted rations.

Although expensive, it is simple and convenient. If not fed in combination with hay or pasture, be sure the complete ration contains at least 25% roughage (e.g. alfalfa pellets). Although these rations may be nutritionally sufficient, they still lack bulk and will leave your Llamas looking for more. Don't be tempted to overfeed the ration. Because these rations will generally be pelleted, Llamas may occasionally choke-a very undesirable consequence.

Special Feeding Situations

Changing Feed Any change in your feeding program should be implemented gradually. When switching from one hay to another, or even from the bales of one cutting to the bales of another, it is advisable to mix the two together, gradually increasing the amount of new hay.

Late Gestation and Lactation In the last 2.5-3 months of pregnancy, a gradual introduction of cereal grain (oats, corn, etc) could be given to a maximum of one pound daily with a simultaneous reduction of forage. Continue this level of nutrition for the first three months of lactation with a gradual reduction until weaning. If your Llama is already fat, by no means offer her a grain supplement!

The Bottle Fed Baby Premature, weak or orphaned babies must be monitored closely so that individual needs, which can vary greatly, are met. Bottle feeding should be minimized because of the bottle-fed Llama's strong tendency to imprint on and become aggressive toward people. If bottle feeding is necessary, the author recommends the baby receive

10% of its body weight in colostrum (ex. 25# cria gets 40 ounces) in 2 to 3 feedings within the first 6 to 8 hours, but certainly before 18 hours of life.

Colostrum is the new mother's sweet, thick, first milk secretion. The baby's survival is dependent upon receiving colostrum for immunological protection against disease, and for important nutritional starters (lactose for energy, vitamin A and some fat). Goat or cow colostrum may be substituted if Llama colostrum is not available, but it is imperative that only first milking colostrum from any species source be used. Beginning the second day, the baby Llama should receive no less than 10% of its body weight per day in goat milk if Llama milk is unavailable. A second choice is "Land O'Lakes" lamb-milk replacer, preferably non-medicated, (diluted 1:6 parts water), or a comparably constituted product. Extreme caution should be taken regarding cleanliness of equipment associated with bottle and tube feeding.

The Growing Baby Llama babies just two to three weeks old will nibble at forages. It appears they are not effective consumers of feedstuffs, however, until two months of age. Young Llamas generally eat with their moms, but creep feeders with limit fed 16% protein grain and hay mixes may be used effectively from three months of age to weaning.

Watch the baby's calcium:phosphorus balance as crooked legs may result from inadequate phosphorus intake caused by excess calcium in the diet, especially in alfalfa hay. A free-choice mineral supplement with phosphorus is crucial during this rapid growth period.

The Weaned Mother Young Llamas are usually weaned at 4 to 6 months of age when the mother is well beyond peak milk production and is approximately 3 to 5 months pregnant. She should be on a maintenance diet only, which is nicely satisfied by grass or oat hay. Tapering off any grain feeding and stopping it completely at the time of weaning will aid in reducing milk flow.

The Malnourished Llama Classically it is assumed that malnutrition means underfeeding. However, in Llamas there are two extremes as overfeeding, unfortunately, is becoming more common. Overfeeding can cause animals to overheat in hot weather and have fertility or birthing problems.

The "underfed" Llama may not be simply underfed, but rather undernourished because some anatomical, physiological or disease condition causes poor utilization of food. If the principle problem is that they are being fed nutritionally inadequate food, a careful and gradual increase of dietary intake should take place under supervision of a veterinarian or nutritionist to bring feeding up to optimum levels.

The Fat Llama A target weight is to be established for the fat individual. Total control of dietary intake is assumed. One percent of target body weight in dry matter forage is offered along with free choice minerals. If more than one individual is being dieted, be

sure to provide adequate bunk space so as to minimize competition. Prevention of fat Llamas is easier than the treatment.

Cold Weather Considerations Normally most Llamas are not on full rations (i.e. 1.8% of body weight) of dry matter forage year around. When truly cold weather (below freezing) settles in, then a switch to free choice consumption will generally be adequate. For the truly unique situation requiring increased caloric density plus free choice forage, up to 1 lb/animal of cereal grains (corn/oats/barley) could be offered.

Heat Stress Prevention Since the heat increment production from forage digestion is greater than for concentrates, careful use of grains during hot humid weather along with reduction of hay consumption should have a favorable effect. However, crude fiber intake still needs to approach 25% of diet.

The state of the art of Llama nutrition is currently based on extrapolation from work in South America, nutritional trials using North American feedstuffs, and opinion based on observations and experiences here in North America. The foregoing will hopefully serve as a guide to keep your Llama's nutrition in a middle-of-the-road path. Good common sense and attentive daily care goes a long way in raising a well-fed (not overfed) and content Llama.

SUPPLEMENTAL READING

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5. Johnson LW: The Llama Stomach: Structure and Function. Llama World 1983; 1: 12-13.
6. Biggs S: Backcountry nutritional needs of Llamas. Llama Life 6, Summer ed, 1988, p 15.
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Llama Herd Management

Though herd management includes all aspects of dealing with and caring for your Llama herd, this brochure is intended to provide information only on the physical handling and care of Llamas in a typical herd situation.

Herd Grouping

A Llama herd is a dynamic system with subgroups requiring special treatment or separation from each other. A good herd manager must pay careful attention to these groupings, especially as the herd increases in number. Keeping a precise record of transfer of animals from one subgroup to another, breeding and birthing dates and health notes will assist in developing accurate genealogical information and in making medical decisions.

The main herd typically consists of all the females (bred or open) and their young offspring of both sexes. An adult male may be kept with this group if he is your choice for breeding to all of the females. Keep in mind that female Llamas are induced ovulators, without a heat cycle, thus can conceive year round. Maidens are normally bred at 14-18 months of age depending on their size and the season, but have been known to be fertile as early as four months of age. Males become potent when they are 1-3 years old.

Expectant mothers within a few weeks of their due dates are often kept together in a separate group so they can be monitored for signs of impending delivery. When possible, they should be kept in a pasture that is easily checked. No male should be kept with this group because the scent of a female approaching delivery may stimulate breeding behavior. Even geldings or juvenile males may pose a threat to the baby by attempting to breed during the birthing.

Llama babies have special nutritional needs. Many breeders provide free-choice feed supplements for babies, who begin nibbling at solid food when they are only a few days old. A creep feeder, an area which babies can enter to obtain special or additional feed without competition from adults, may be free-standing or partitioned off inside the barn. Larger Llamas can be denied access by making the entrance only 30-34" high. A 4" high threshold board will keep adults from crawling through the entryway.

Babies ready for weaning should be separated from their mothers for at least one month. Weaning is usually done when the baby is 4-6 months old, depending on its size and the condition of both mother and baby. By that time the baby is able to provide for its own nutritional needs, and the mother, who is usually rebred, may be nutritionally stressed if she must produce large quantities of milk for a nursing juvenile while supporting her growing fetus. Note that the key to weaning is separation, and either mother or baby may be removed from the main herd. Many breeders feel that removing the mother creates less stress on the baby, who remains in familiar surroundings. Separation of a pregnant

mother also presents less of a management problem since she can be kept with juvenile males, geldings or even with a stud. Separation by a single fence is not adequate because the baby may nurse through the fence. Stress on both mother and baby will be reduced if they are out of each other's sight.

Juvenile males (6-24 months of age) are often treated as a separate group. These young males can cause problems in the main herd by "play breeding" the females which may trigger ovulation, and confuse or disrupt a controlled breeding program. Juvenile males should be separated from adult males by more than one fence line, since the youngsters seem compelled to pester until they provoke an attack.

Gelded (castrated) males of any age can usually be kept together without problems. Many responsible breeders recommend gelding all males who will not be used as studs. Castration is a simple, safe and relatively inexpensive veterinary procedure which is sometimes done as early as six months of age or any time thereafter. Depending on disposition and temperament, geldings may be kept with the main herd or with any other subgroup except expectant mothers.

Whole adult males represent a real management challenge because they fight. Fighting males scream and bash into each other so violently that they may cause serious damage to themselves or to your facility. Even across a single fence they may cause enough commotion to disturb the neighbors and disrupt the peaceful atmosphere of your Llama ranch. The most satisfactory way to deal with stud Llamas is to keep each one separated from any other subgroup and from other studs, preferably by at least two fences. Sometimes a stud is kept with the main herd, but he may breed related females, juvenile females or females in labor, or injure young males. Some owners successfully run all males together, but they must be kept out of sight of females.

Newly acquired Llamas are a subgroup for which separate accommodations may be desirable. Depending on the information available about the health and management of the herd of origin and whether new animals have entered that herd recently, it may be wise to provide a quarantine pen or field to isolate newcomers for a reasonable period of time until their health status is certain. A quarantine area should be organized so that contact with other llamas is not possible.

Herding, Catching and Holding

Before attempting any procedure which requires handling untrained Llamas you will want to put on leather boots to protect the top of your feet from injury if a llama accidentally steps on them with its hard toenails. Light gloves will protect your hands from incidental scrape, and sunglasses or other protective eyewear will allow you to face a llama unflinchingly in the unlikely event of threatened spitting.

Handling Llamas, moving them from one place to another, catching and holding them for examination or treatment requires a basic understanding of the species. Individual animals may react in different ways, but a few generalizations about llama psychology will help you deal with your animals more efficiently.

- Llamas are quick learners, easily conditioned, and are willing to comply with the wishes of their human handlers if the intent can be communicated and if the humans can demonstrate their control of the situation.
- Llamas are uncomfortable about abrupt movement, direct eye contact, the silhouette of a human with arms widespread and about being touched, particularly by human hands.
- Llamas have a strong tendency to move as a group when being herded.
- Llamas instinctively oppose any pressure you apply against their body. It may be valuable to realize that pushing a Llama to the right will usually result in it leaning to the left.
- Llamas are not very responsive to physical punishment or to the most common incentives used in training other types of animals (treats, petting, praise).
- Llamas are repelled by agitated behavior and calmed by a relaxed, peaceful attitude.

To herd a group of Llamas in a given direction, apply herding pressure from the opposite direction. If there are no factors which repel the group (people, fences or other physical obstructions) or attract it (another group of Llamas or anything which excites their intense curiosity) you can assume that they will move directly away from you. In an open pasture you might begin herding pressure at a distance of 50-100' from the nearest Llama, gradually approaching the group until they begin to flow in the opposite direction. Additional herdsman can help focus the herding pressure. Some Llama handlers use herding poles (plastic pipe or bamboo 12-15' long) or ropes stretched between herdsman to extend their influence on the animals.

Once the Llamas begin to move, or as the distance between you and them decreases, it may be desirable to lessen the pressure by moving more slowly and with more relaxed body language. Your success will be enhanced if you move the whole group, not allowing even a single Llama to split off in another direction. Keep them moving along smoothly so they do not begin to consider other options. A single herdsman attempting to drive a large group of Llamas may have to range from side to side to include all stragglers.

The object of most herding is to move the animals from a larger area to a smaller one where they may be sorted or caught.

Once you are among the animals in a confined area, project a calm and reassuring image, eyes lowered, movements slowed and hands at your side or behind your back. Many Llama handlers imitate the llama's soft moan or hum to calm them.

Sorting, separating one group into smaller groups, is most easily done with at least two people. After the whole group is herded into a confined space, a corral or small pen, one handler can be stationed at the gate to another pen, allowing the desired animals through and blocking the passage of others. Meanwhile, other handlers exert mild herding pressure on the group to present different animals to the gatekeeper for the sorting process. A herding pole makes maneuvering the animals much easier.

The best way to catch an individual is to herd it into a corner or small space where escape is impossible. Most Llamas will surrender peacefully in this situation, especially if you allow a few seconds for them to adjust to the idea. If you feed in the barn or in a small pen at the same time each day, you can simply wait until they go in, then close the gate and quietly move the individual animal into a corner.

To make first contact with an animal that seems resigned to being caught, slowly and deliberately place a hand on its back.

After a few seconds move your body alongside the animal and either halter it or "ear" it by running your hands up both sides of the neck from behind, maintaining firm contact until you reach the base of both ears. The ears may be grasped firmly if the animal decides to struggle, but often simply cupping and massaging the base of each ear between your thumb and index finger will distract and calm the animal enough for routine examinations or treatments. Additional handlers in contact with the Llama will lessen the chances of a struggle.

Catching a Llama in a large field usually requires several people. An adult Llama is a physical match for most people, and an untrained animal in the open is much more likely to bolt when surrounded and to struggle when caught. One technique is to use ropes stretched between the handlers to make a moving corral and to snag the animal if it tries to run through. The success of this approach depends on quickness and coordination, because the rope usually stops the animal for only a few seconds. Another method is to herd the animal against a fence or into a corner of the field where one or two handlers can move in to catch it. If it shows any intention of going over the fence, which in the case of barbed wire is a real danger to the animal, pause 6-10' away and wait a few seconds for the animal to calm down before approaching it. Experienced Llama handlers may be able to accurately judge the moment of hesitation by the Llama as it tries to decide which way to escape. By moving quickly at this moment, one person usually can restrain it long enough for others to assist. Unless you have confidence that you can act decisively at just the right moment, wait until the Llama will tolerate a slow, deliberate approach, even if that takes a minute

or more. The risk of injury and stress for both the animal and the people involved makes an open-field catch a very poor second choice to a controlled catch in a confined area.

Nail Trimming

Some Llamas have toenails that grow too long or twist to the side. Periodic trimming will improve their appearance and help prevent foot soreness. This procedure may be necessary only once a year and many Llamas never need it.

Nail trimming may be done with side-cutting nippers designed for use on sheep and available at many feed stores or through veterinary supply catalogs. The animal may have to be restrained. Any of several types of Llama restraint chutes on the market work well for this purpose. Some Llamas will allow nail trimming while standing, either haltered or gently eared. Others may need to be held down on their side by two or three handlers. Adult male Llamas can often be trimmed quite easily while breeding.

The object of nail trimming is to cut away excess horny material. Care must be taken not to cut the sensitive quick that is supplied with nerves and blood vessels. Lay the nippers along the length of the toenail. Trim along one side and then the other of each nail. One additional cut across the tip may be necessary.

Removal of Fighting Teeth

Male Llamas have sharp-edged fighting teeth or fangs which may begin to erupt by two years of age. These teeth are along the side of the jaws about halfway back. There are two fangs on the upper jaw and one on the lower on each side of the mouth. Llama fighting teeth have a very sharp point and sharp cutting edges front and back, much like a shark tooth. They represent a danger to other Llamas and to humans, so they should always be removed or blunted. Some Llama owners choose to have tooth removal done by their vet, but many feel that the procedure is simple enough to be considered a routine part of their herd management.

The most commonly used technique for removal of fighting teeth is to cut them off at the gumline using a flexible braided cutting wire known as obstetrical or OB wire, available from your veterinarian. Special metal handles are available for gripping the ends of the OB wire, and if these are used a 24" length of wire is adequate. If no handles are available, the ends of the wire must be wound around your gloved hands or fingers, so allow a few extra inches.

Restrain the animal in a chute or by cross tying from the cheek rings of a sturdy halter to two solid posts about 3-6' apart. A third lead line from the chin ring of the halter will provide additional control. If enough helpers are available one can firmly ear the animal.

Carefully retract the lips on one side and hook the wire behind the forward upper fang. The fighting teeth are slightly curved backward, so the wire will find its proper position at the gumline as you pull the ends of the wire forward. The OB wire is designed to cut only hard tissues like bone or tooth without cutting soft tissue, so once the wire is in place the animal may be allowed to close his lips around it.

Both ends of the wire should be directed forward out of the mouth, one end held in each hand. Draw the wire across the tooth by pulling first with one hand and then the other at a rate of about one stroke per second while maintaining a firm pull on the wire. Usually the fang will be cut off neatly at the gumline in about 15-20 seconds. There may be a little bleeding from abrasion of the gums, but this is no problem. Any sharp edges or points that remain can be smoothed with an ordinary metal file. Make sure that the sharp, severed crown of the tooth is out of the animal's mouth before going on to the single lower fang on the same side, and then the rear upper fang. Repeat the process on the opposite side. After one use the wire will coil when tension is released. This makes placement on subsequent teeth a bit more difficult, but the same piece of wire can be used on all six teeth and even reused on additional animals.

Fighting teeth can be cut off as soon as they have erupted even 1/4" and this is sound management policy. The teeth will continue to erupt until the animal is 4-5 years old, so put a reminder in your files to check the teeth of your males every 6 months and redo the procedure if necessary.

Female Llamas can get small fighting teeth. These erupt much later and usually are not removed.

Waste Management

Llamas instinctively deposit their manure in communal dung piles. This trait may reduce the spread of internal parasites, because the animals will not eat the grass near any of these piles.

Llama dung is pelletized and nearly odorless. In the high, dry environment of the Andes, Llama pellets are used by the Indians for fuel. Dried pellets burn much like charcoal briquets, but the smoke has a pungent aroma.

Llama dung usually does not cause a serious odor or fly problem, but most owners clean up the dung in barns, corrals and pens. Though fresh dung may be used for fertilizer without burning garden plants, it is usually composted in large piles along with used bedding materials like straw or sawdust, and waste feed or moldy hay. After a year or more the composted material may be mixed into garden soil for an excellent fertilizer or used on the surface as mulch. Because Llamas will not eat dung-contaminated grass, it is not

productive to spread it on pastures except in areas that will not be grazed by Llamas for several months.

When introducing Llamas into a new field, you may be able to designate the position of dung piles by "baiting" desired spots with dung.

Avoiding Hazards

Llamas are "easy keepers" compared to any other kind of domestic livestock. They are not prone to accidents and injuries. Still, a good herd manager will anticipate hazards to the animals and take steps to avoid them.

Predators which can threaten Llamas include coyotes, bears, cougars and, most significant of all, freeroaming dogs. Most of these can be discouraged by wire mesh field fencing, a guard dog on the property or by bringing the herd into a protected area at night.

Be sure to pick up and dispose of all placentas and provide extra protection for newborns. Where wild animals are a serious threat, predator control programs may be necessary.

Skunks may carry rabies in many areas, and Llamas' natural curiosity may draw them close enough to be bitten. The only real defense is to vaccinate against rabies in high-risk areas.

Porcupines can be a hazard to curious Llamas and guard dogs. Quills are more easily removed after they have been snipped with scissors to release pressure in the barbs. Special fencing may be warranted.

Deer can carry diseases and parasites. Protection of a Llama herd from contact with deer is very difficult, but good high fences and a guard dog may help. White-tailed deer, particularly in wetland areas with snails, can carry the deadly meningeal worm. You may need to use a systemic wormer on a regular schedule.

Plants poisonous to Llamas include oleander, choke cherry, rhododendron and hemlock. Find out what poisonous plants grow in your area and eliminate them from your property.

Small apples can be a hazard to Llamas, and choking fatalities have occurred. It is probably best to prevent access to orchard areas at times when there are small apples on trees or ground.

Phosphorus fertilizers and other chemical poisons should be properly stored where animals cannot come in contact with them. If chemical fertilizer is spilled in the fields it should be cleaned up before Llamas are allowed to graze. Bulk seed is sometimes treated with insecticide, so spills or open seed containers can be dangerous.

Sharp projections of fence wire should be trimmed and other sharp objects in the fields or barns should be removed, blunted or covered. Llamas' large, protruding eyes are especially vulnerable. Though Llamas have tough skin rarely injured by barbed wire, many owners replace barbed wire with smooth wire as a precaution.

Ditches and dust baths can pose a threat. Potentially dangerous ditches, especially deep, narrow ones, should be filled in or widened. Because Llamas can become trapped on their backs by rolling up against a fence, barn or wall, it is best to prevent use of dust baths uphill from these or other hazards.

Ice may cause serious falls, especially in sloping areas. Llamas will try to avoid areas of slippery footing, but you may want to spread sand or salt at times.

Grain overdose can be fatal to Llamas. Take care to keep your grain and other feed supplements in covered containers in a secure area. Forgetting to close a door or gate to the grain storage area can have heartbreaking results.

Good Llama herd management is based on an understanding of the animal and on common sense. Get to know each of your Llamas and observe their behavior at least once each day to make sure they are acting normally. Try to anticipate. Seek the advice of experienced Llama owners or consult your veterinarian about problems that arise.

So You Want to be a Mama Llama

Notes on Reproduction, Birthing & Care of the Newborn Llama

Raising llamas is fun. These unique animals are rewarding spiritually and financially. Whether they began raising llamas as a business or a hobby, many people have had their lives and lifestyles totally changed by these lovable, easy-to-care-for creatures.

One can quickly become a member of the growing ranks of Llamaphiles. No matter how long you own llamas you can learn something from or about them every day. They are kind, clean, quiet, peaceful, stoic, cute, uncomplaining and beautiful.

This paper covers basic information on breeding, birthing and common problems and procedures for care of mother and baby. Welcome to the wonderful world of Llamas!

Breeding

(Shearing both males and females before breeding makes the whole procedure cleaner and healthier.) When is your llama old enough to breed? Males become fertile between 10 and 36 months of age, with the average being 24 months. In fact, from several months of age

on, young males will mimic adult breeding males. These youngsters are often seen playing by piling on top of each other, a female in prone position or a male in the act of copulation.

The female is normally ready to be placed in the breeding herd between 15 and 20 months of age, or when she has reached approximately 60% of her adult weight. A female may conceive as young as four months, but this is extremely rare. Pregnancy at an early age can endanger not only your Llama's life, but her health and physical development as well. If a mature breeding male is living in the same field as females with babies, the young females should be weaned and removed at 4-6 months of age (depending on their size and condition), or they and their mothers should be separated from the breeding male.

Since Llamas do not exhibit common outward signs of estrus or heat (as cattle or horses do), it is difficult to ascertain the day a female might be receptive to a male unless you actually see them breeding, or can "handtease" the female by presenting the breeding male to an isolated female to detect receptivity. You will not always see your female being bred because copulation often occurs at night as well as during the day. Llamas, like other camelids, are induced ovulators, which means that the act of copulation will set into gear the mechanism initiating ovulation. During copulation, both the female and male are in prone, sternal position for 5-50 minutes. A non-stop array of sounds from humming to grunt-chortling and orgling may be heard.

Females probably begin a follicular wave pattern about three days post partum. Normally the female remains receptive to the male until she has been bred and ovulated, although spontaneous ovulation can occur. Because it takes about 21 days for the uterus to totally involute and clean up, we recommend waiting this period of time until breeding. Your female should be checked for any outwards signs of discharge before being put in for breeding. Having your veterinarian do a vaginal check with a speculum 14-21 days post partum is highly recommended.

Because ovulation is induced, Llamas may breed and conceive any month of the year and produce healthy babies. As a result, you may want to regulate the length of the breeding season according to your climate and conditions by introducing and removing the breeding male at specific times of the year. Where winters are severe, hypothermia, frostbite and exposure to cold rain or snow are factors to consider, just as extreme heat, humidity or dryness are in summer.

Gestation & Signs of Pre-Parturition

Gestation is normally between 335-365 days, with 350 days as a mean. Our ranch has yet to induce labor in a Llama, preferring to let Mother Nature take her course. As the time of birth, or parturition approaches, you may notice some, all or rarely any of the following signs that are seen when kneeling or on your hands and knees beside or behind your female. (You will be surprised at how much shearing your female helps all observation.)

1. The posterior portion of the abdomen becomes gradually more distended.
2. The udder begins to swell close to the body. The swelling then continues into all four quarters, which normally have one nipple per quarter.
3. 1-72 hours before parturition the nipples may swell and become tight and warm with globules of sticky colostrum (the first milk) on the nipple tips.
4. The lips of the vulva may elongate and swell, relaxing for the imminent birth. When the female is resting in basic (sternal) position or goes on her side, the vulva may part, showing some of the inner vaginal lining. Do not become alarmed. This is normal.

Delivery

Llamas give birth in daylight hours unless a problem with presentation occurs. Any difficult birth is called dystocia. There is no special English term for the process of the Llama giving birth (like foaling, calving, lambing). Birthing or parturition are most commonly used.

The mother-to-be may stay off by herself for several hours to several days before giving birth. She may also seem more subdued and quiet than usual, lay down and stretch out sideways and emit louder, more frequent distressed humming sounds, or "Llama talk", than normal. If she lives with a male, this is a good time to separate her, as breeding males will occasionally try to mount a birthing female - not a good situation for the mother or unborn baby!

Your Llama will give birth in a standing-squatting or prone position. If all is well, the water will break, lubricating the birth canal, and a small shiny bag will be pushed out (it may appear and disappear several times before remaining out). The front feet, nose and head should follow, and may sometimes be seen inside the bag. With the next strong push, the sack is usually ruptured by the extension of the legs to the outside as the elbows are pushed over the pelvic rim. Sometimes there is a short delay at this time while the shoulders slip through the birth canal. When the rest of the body slides out, the umbilicus is automatically disconnected.

Usually all of the placenta remains inside with nothing hanging out or showing until the entire placenta is expelled later.

Since most babies are delivered while the female is standing, fluids in the lungs, trachea and nasal passages have a chance to drain out due to gravity before the baby is dropped on the ground head first. If the baby is having trouble breathing, do not be afraid to give mouth to mouth resuscitation or hold it by the hocks and swing it around to expel fluid from the lungs.

The baby will be delivered with a unique thin membrane (the epidermal membrane) covering its entire body and attached to the lips and toes. Make sure the nasal passages and mouth are clear of mucus and other debris, including the membrane which is sometimes tightly adhered to the edges of the lips and the nostrils. After toweling off the baby (called a "cria" in Spanish) carefully follow the standard operating procedures outlined below. In the case of first-time mothers, it is helpful to move the mother and baby to a quiet stall or paddock, in sight of and in close proximity to Llama friends so bonding can develop uninterrupted. Simply pick up the baby and the mother will follow. In hot weather, a shady spot with fresh water and hay or grass should be provided.

Llamas are good mothers and love their babies, but they are passive and do not lick their newborns or eat the afterbirth.

They do commonly smell and touch the baby with their nose.

Neonatal Care

The following procedures are both recommended and commonly used, but may not be applicable in every situation.

1. Treat the navel with Betadine, or a 50/50 mixture of 7% iodine and Betadine, or use any antibiotic ointment if the above are not available. If the umbilical cord is dripping or pumping blood it should be clamped or tied off 1 to 1- 1/2" from the body. Special ties and clamps can be obtained from your veterinarian or, in case of emergency, short pieces of dental floss or suture material work well. Use care in tying these materials to avoid amputating the stump. If the umbilicus is already dry or has been contaminated with dirt, treatment is not recommended.
2. Give a warm enema - squeezing gently. If the baby later appears to be straining even though it has previously passed a quantity of meconium (the first fecal material), it may be necessary to give another enema. A drop of liquid Ivory soap in 4-8 ounces of warm water is fine. A human Fleet enema, warmed in a bucket of hot water, also works well. Your veterinarian may recommend injectable Vitamin A and D at birth.
3. If corona virus has been diagnosed on the farm or ranch, administer an oral vaccine as a preventive for diarrhea caused by this bovine virus.
4. Only if in a selenium deficient area, administer injectable selenium (Bo-se) subcutaneously or intramuscularly in the hind leg.
5. Weigh each baby at birth and monitor its weight carefully for the first week, or longer if necessary. Normal birth weight is 22-35 pounds. Most crias either lose or maintain weight for the first day or two, but should gain a minimum of $\frac{1}{2}$ pound per day thereafter. This gain may be irregular but should average out.

6. Other vaccines or anti-toxins may be indicated in your area. Your veterinarian will best advise you in the matter.

7. The baby should ideally have colostrum within the first 2-4 hours of life because of the natural laxative effect of this milk, the energy provided by the nutrients and the high antibody content. It is known that colostrum is produced only during the first 24 hours of lactation and that the cria dramatically loses the ability to absorb the antibodies after 24 hours of age. The newborn Llama is born without any antibodies. Therefore, it is of the utmost importance to be sure that all neonates receive adequate colostrum as soon as possible after birth. An IgG test may be done 24-48 hours after birth. If the IgG (immunoglobulin) level is not adequate, a plasma transfusion may be necessary.

8. We also recommend desensitizing crias at birth, this includes laying the cria on a towel and touching, rubbing and flexing all parts of the head and body. 15 - 20 minutes twice a day for the first few days works wonders for later training. DO NOT TALK while handling the cria. We want baby to bond with mom, not with us. First day of life priorities are: 1) Be positive the baby is actually nursing. 2) Be positive the baby has passed fecal material. 3) Be positive the baby has urinated and that no urine is leaking from the umbilical area.

If you have any reason to think your baby has a problem, call your veterinarian and have a physical exam and a complete blood count (CBC), and Routine Llama Panel (RLP) done.

When the Baby Won't Nurse

The author's personal tips:

1. It will be much easier for baby to find the "right place" if mom is shorn. Crias can and do die from ingesting fiber.

2. Prime the pump by milking the mother and putting the milk in a stubby bottle with a sheep nipple (hole slightly enlarged) or other apparatus of similar nature. Two to four ounces every 4-6 hours is a normal amount to expect. After the baby has sucked down 1-2 ounces, place it at the mother's side and coax it to nurse. It helps to gently rub and blow warm air on the baby's hindquarters, especially on top in front of the tail in imitation of the mother. This and "humming" help initiate the search and nurse response. (Macho guys don't laugh - you can do this too). Babies should be up and nursing within two hours.

3. Each neonate needs to receive 10% of its body weight in milk or milk replacer each day in order to grow and gain normally. If the baby will not suck from the bottle or nurse, it should be stomach tubed. Using a Lady Clairol type bottle and a 16" cat/puppy tube, place the Llama in a sternal position between your knees. Bending over and holding the head in your left hand, insert tube (unattached and lightly lubricated) through the baby's mouth and into the esophagus which you should normally see or feel on the left side of the neck. To make sure you are not in the trachea, listen at the end of the tube to be sure there are

no breathing sounds or suck back gently on the tube. You should be able to feel the resistance. Attach bottle to tube when tube is about 12" down. Squeeze gently, giving 4-8 ounces. Repeat every 4 hours if the baby is not nursing on its own. Then, stand the baby at the mother's side and coax to nurse.

4. Do not be afraid to perform all of the above with baby males, even if it takes several days. They do not turn instantly into "berserk males" - just treat them like Llamas taking care not to cuddle or talk to them.

Post-Partum Care of the Mother

Milk a squirt from each teat to dislodge the small plug of colostrum in the opening. If the udder is small and there is little or no milk, hot pack and massage it with warm water. Your veterinarian may suggest giving an injection of oxytocin sub-cutaneously or intramuscularly. If, on the other hand, the udder is tight, distended, hot or swollen, milk out as much as possible and feed it to the baby from a bottle. Keep milking every few hours or until the baby is nursing on its own. If the female is a heavy milker, extra milk should be frozen and put into a colostrum bank for future use. Rarely, it may be necessary for your veterinarian to administer an injection of Lasix to reduce udder edema and make the milk come more easily. If Lasix is given, make certain free choice fresh water is available for mother. Should blood be noticed in the milk (causing a pink tinge), the mother may have mastitis and should be checked by your veterinarian.

The mother should be watched carefully for the first week. If any discharge or pus is noted coming from the vulva after the first few days, ask your veterinarian to check her to determine whether or not she needs to be cultured and/or infused intra-uterinely. This will be an easy matter for the veterinarian to decide.

The placenta (afterbirth) should be passed within 4 hours and often comes shortly after birth. Call your veterinarian if after this length of time you cannot find evidence of the afterbirth or if membranes are still hanging out. Do not pull on the membranes since this can easily cause hemorrhage and/or retention of pieces of the placenta in the uterus and predispose the Llama to uterine prolapse. Treatment should definitely be decided by your veterinarian and often includes the use of systemic antibiotics along with intrauterine treatment.

Weaning

Babies are most commonly weaned by the age of 6 months. We halter train our crias before weaning. Except in extremely rare instances, male and female weanlings may be safely placed together until the age of 1 year. This is also an excellent time to further train and work with your new llama.

Finally, the most important thing to remember when your Llama begins to give birth is DON'T PANIC! Most of the time there will be no problem. If you suspect a problem and delivery seems prolonged, call your veterinarian immediately. If help is not available, pray and use your good common sense. If a neonatal care clinic is being held in your area, do attend it.

Llama Housing & Fencing

Although their original habitat is the arid, high altitude regions of the South American Andes, Llamas are quite adaptable, and with good care they are thriving in climates from Florida to Alaska, Europe, Great Britain, Australia and New Zealand. Llama facilities need not be elaborate, but adequate shelter and fencing are necessary. When planning housing and fencing, the animals' health, safety, and comfort are major concerns, as is the convenience of their caretaker. The more easily daily maintenance is done, the more time there is for training and enjoying one's llamas.

Shelter and Housing

Climate largely governs the type of housing needed for Llamas. Some kind of shelter in the form of trees, sheds, or barns is necessary.

In considering the type and size of shelters needed, it is important to keep in mind that llamas treasure their freedom to come and go. They are more apt to use shelters with large doors or windows that give a feeling of openness than dark stalls or sheds which give the feeling of being shut in.

A general guide to the minimum shelter space for compatible pasture-mates is that five adults or seven yearlings shelter nicely in an open 12 x 16 foot shed, and six mothers and babies fit comfortably in a 16 x 16 foot shed. The key is congeniality. If an animal is forced to stay outside, it may suffer. Some owners successfully house with even greater density, especially in cold weather conditions.

In warm climates shade is essential, as Llamas may suffer heat stress and even heatstroke, when the temperature rises, especially if the humidity is also high. Although they sometimes lie stretched out in the sun when it is very hot, they will more often seek shade and other means of cooling themselves. In areas of high temperature (110° F) or high summer humidity, Llama owners have successfully maintained their animals by providing sprinklers, misters, streams, ponds, and plastic wading pools for cooling. An area under shade with deep sand kept damp is effective. Young shade trees should be fenced or wrapped with wire to prevent debarking by nibbling Llamas. Large fans used in a shaded area have proven useful.

In rainy climates where the ground may remain soggy for long periods of time, Llamas should have housing and holding areas where their feet can dry out every day, preferably where their hay and water are provided. This should avoid a possible "foot rot" condition, which, though not common, is very difficult to heal.

Cold climate housing varies considerably, depending upon weather severity and relative wooliness of the Llamas. It is a common misconception that the Llamas' native high altitude habitat is very cold. The Andes' proximity to the equator provides average extreme temperatures of 20 to 55° F. Although it commonly freezes at night, the temperature rarely falls below 10° F.

In climates where temperatures do not drop lower than 15° F for long periods of time, three-sided wooden "loafing" sheds are usually sufficient. They should be oriented to afford maximum protection from prevailing winds and storms. In regions where cold temperatures range frequently from -20 to 15° F, large barns or enclosed shelters provide the best protection. Under these conditions, less woolly llamas need special consideration and should be watched for signs of hypothermia. Where temperatures remain below -20° F for extended periods, insulated and heated barns are commonly used for all livestock, including Llamas. Enclosed barns should have adequate ventilation for fresh air and good straw bedding for warmth and cleanliness. When unprecedented cold spells occur in regions without heated barns, essential body heat can be preserved by forcing compatible Llamas to cluster close together in barns or sheds. Provide extra feed during cold weather when additional calories are needed to maintain body condition. Older, or sick, Llamas may need a warm coat during a particularly cold period.

In any climate it is useful to have at least one stall where a mother and newborn baby or an ailing member of the herd can be confined. A pair of heat lamps mounted on the walls will help warm a baby born in cold or damp weather and may prevent frostbitten ears. Heat lamps should be firmly anchored and mounted high enough so an adult Llama cannot singe itself. Baby llamas must learn about their creature comforts and should be watched closely the first week or two, if born during extreme weather conditions. Even a normal, healthy baby may need protection of a coat or jacket in the first two weeks during very cold, snowy or rainy weather.

Feeding Facilities

While most llamas seem to prefer feeding outdoors, they do not like wet hay. Waste can be avoided if some feeding mangers are located indoors for wet weather use. Hay racks with a catch tray below work fine for grass hay, but llamas will waste less hay if flat-bottomed feed bunks at least 2 feet wide are used. To decrease chances of their picking up parasites, Llamas should not be fed on the ground or near dung piles.

Llamas need a regular supply of clean water. In subfreezing temperatures, electric floats or submersible stock tank heaters are necessary.

Catch Corrals and Chutes

For ease in managing one's herd, small catch corrals or pens are necessary. To facilitate catching individuals or groups of llamas for training, brushing, vaccinating, nail trimming, etc., build catch corrals in the area the llamas are accustomed to entering for food and shelter.

A chute built into a corner of a small corral aids the handling of routine health procedures and medical emergencies. Several portable restraint chutes designed especially for llamas have been developed, but a simple chute can be built using sturdy wooden posts and two fence poles for each side. The chute should be about 2 feet by 5.5 feet, with the top pole about 45 inches from the ground, and located so that the Llama is accessible from all sides. It need not open at the front, since llamas easily learn to back out.

If desired, removable plywood side panels can be wired to the side poles to form solid walls.

Depending upon the arrangement of the barns and corrals, sorting gates are also helpful in controlling the movement of animals between the corrals and separating out individuals. In addition, it is often desirable to have large holding pens or small pastures surrounding the catch corrals to permit animals to be held temporarily without confining them to a small catch pen.

When llamas are kept with other stock such as horses, goats, or sheep, the llamas should be carefully observed to ensure they receive their fair share of feed and shelter, as greedier animals may prevent llamas from eating. If llamas are pastured with horses, it is easy to make a feeding area available only to llamas. Place a single pole across the entrance just low enough to prevent horses from entering; the llamas will easily slip under the barrier to eat and rest without competition.

Fencing

What constitutes adequate and safe fencing for Llamas varies enormously. It is often easier to caution against possible dangers and unsuitable fencing than to specify what may be best. In some circumstances a 3.5 foot-high, two pole fence may suffice, while elsewhere a 5.5 foot chain link or v-mesh fence might be necessary.

The nature of llamas and how they behave in given situations governs the choice of fences. Much depends upon herd size, pasture sizes and proximity, number and ages of males, females, and geldings, make-up of living-groups, the necessity of weaning babies at five to

six months, and keeping young females separate from stud males until they are of suitable age for breeding.

When llamas are content in their living-groups and are left with their usual companions, even if just one other Llama, they generally respect standard 4 foot fences used for other large livestock. However, llamas are very agile and can easily jump 4.5 feet when they feel the need to do so. They are equally adept at crawling under or through fences. Weanlings can be true escape artists in their efforts to rejoin their mothers, and stud males may jump or crawl under a fence to breed an available female. As long as llamas have adequate feed within their pastures, they seldom put pressure on fences to reach more. Tasty treats such as asparagus and apple or other fruit trees, however, may tempt them.

If one stud male and a group of females are kept together there is usually little strain on fences. However, if several stud males are kept in adjacent pastures or paddocks, or next to a group of females, fences need to be more substantial. Adjacent studs may rear up, lean on, reach over and even lunge against gates or fences while "defending their territory" against neighbors. Fences and gates separating stud males should be at least 5.5 feet high.

Another factor to consider is the presence of wild or domestic predatory animals. A major threat to llamas is roaming domestic dogs, which have killed and injured many llamas. In some areas peripheral fences must be dog proof. Forty-eight-inch field fence set tight to the ground with one or two smooth wires running above it will usually discourage all but the most determined marauding dogs. Electric fence strung close to the ground or chicken wire partially buried around the outside fence is also an effective deterrent against digging dogs. Gates must also be made secure, as dogs will dig under them. In some areas mountain lions and bears are an increasing hazard, and a secure fence surrounding the llamas' nighttime housing and corral area is necessary. Strong, high fences with electric wires outside and at the top are the best deterrent.

It is more economical to build strong, safe fences at the beginning than to spend time and money rebuilding flimsy ones later demolished by your llamas. Wooden pole or board fences are aesthetically pleasing and are usually safe for llamas, unless there is a problem with dogs entering or young llamas crawling out. Cedar rails are attractive but llamas tend to chew on them.

Among the many kinds of wire fencing available, v-mesh is one of the safest and most durable - but also one of the most expensive. No-Climb fence is safe and strong. Chain link fence topped with either corral poles or sturdy boards works well. If it is used for interior fencing and hung without touching the ground, poles can be run along the bottom to prevent llamas from crawling under. Field fence (rolled wire), which has smaller openings at the bottom and larger ones at the top is relatively inexpensive, is flexible and easy to install on uneven terrain. Its flexibility is a safety factor, as it is quite "forgiving" if a

Llama gets caught in it. The heavier gauge is worth the added cost, is more durable and holds its shape better. High tensile "New Zealand" fence with several of the wires electric to keep out dogs and coyotes is being used successfully by many Llama owners. However, several llamas, both young and mature, have died from "weaving" their necks through the taut wires and becoming stuck.

In some situations electric fence is useful for restraining llamas. However, the hair and hide of llamas' necks are so thick that electric fence shocks do not have much effect there. Putting one inch square pieces of masking tape every few feet along a newly installed electric fence shows the Llama where the fence is and entices them to touch it with their noses, after which they avoid contact with it. Small solar collectors to power electric fences are efficient and economical.

Several kinds of fence are best avoided. Barbed wire is potentially dangerous and is wholly unnecessary for llamas.

Anywhere that single or multiple strands of wire are useful, llamas are restrained just as well by smooth as by barbed wire. Two x four inch welded mesh wire is too light weight for active males, but it may be satisfactory for peripheral fences on even terrain. Any wire fence with squares six inches or larger can cause problems, since llamas stick their heads through such openings. Therefore, when field fence or cattle panels are used for corral fences, it is safer to mount these with the smaller openings at the top and the larger openings at the bottom.

Round metal tube gates are durable and safe, but pole and heavy wood gates are also usable. In planning the location and widths of gates, the problem of the periodic removal and general management of dung piles should be taken into consideration. For cleaning up after just a few llamas, a sturdy wheelbarrow and shovel is adequate, but for larger herds, a small tractor and other mechanized equipment are very useful, and gates must allow their passage.

A Few Safety Tips

Because of their excellent eyesight and agility, llamas are not prone to injuring themselves. However, llamas of all ages tend to stick their heads through any opening including loops in dangling ropes, hay strings, slots in feed racks, gates, and fences. At about three to four weeks of age, baby llamas also go through a stage when they explore their new world by tasting and mouthing everything. Therefore, it is prudent to maintain an environment free of sharp or potentially harmful objects such as bits of plastic, baling twine, or toxic paints.

On the whole, llamas are easy to care for. If you are prepared for the more extreme situations, your llamas will be comfortable, happy, and safe, and you will easily be able to manage and enjoy them to the fullest.