



Llama

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Llamas are one of four main species of New World camelids. The other three species are the alpaca, guanaco and vicuna. These species are thought to have originated from a common ancestor that came across the Bering Strait land bridge. Camelids are thought to be related to Bactrian and Dromedary camels of Asia. The high dependence of Incan Indians of South America on llamas and alpacas for food and fiber is analogous to the Plains Indians of North America and their relationship to the bison. Incas carried their relationship with llamas a step further through domestication and controlled breeding for beasts of burden. With the collapse of Incan culture, llamas were nearly pushed into extinction and only survived in the harsh upper regions of their natural territory. The last 25 years have seen a resurgence of interest in llamas, especially in the United States.

Llamas are first and foremost pets and companions. They are ideally suited to this task because of their predictable low-key temperament, intelligence and ease of maintenance. Wilderness packing is probably the second greatest demand for llamas. Llamas make ideal pack animals for the western mountainous regions of the United States because of their inherent thriftiness in this climate, their low-cost maintenance and their durability as pack animals. Wool may represent another use for llamas, although, with a large number of natural and synthetic substitutes for wool, it seems unlikely that llama herds will be maintained for wool production. In some instances, llamas have been used as a sheep guards against predators. The potential of this market has not yet been verified, but may hold some promise in the future. In some foreign countries, where the resident llama population is quite high, there is interest in using llamas as a food source. But, because of a relatively low population of llamas in the United States (about 35,000 animals in 1992) and a relatively high price, llamas are not likely to become a food source for Americans.

Physical Attributes

Llamas are 40 to 50 inches high at the withers and 60 to 72 inches tall at the poll. They weigh 18 to 31 pounds at birth and should weigh 250 to 300 pounds at maturity. Female llamas reach mature size at 2 years of age and males mature at 3 years. The average life span for llamas is 20 to 25 years. Llamas have a long graceful neck and a relatively small head with large eyes and large curved ears. Llamas are covered with wool which may be 3 to 8 inches in length. Wool covers the neck, back and sides of the animal while the head, underside and legs are covered with short hair. A thick covering of wool enables llamas to withstand cold, wind, snow and rain. Short hair elsewhere on the body enables the llama to dissipate heat when placed in warmer environments. Unlike sheep wool, llama wool does not have the protection of lanolin to make it water resistant. Llamas have a tail that measures 12 inches in length at maturity. Llamas have characteristically high-cut flanks accented by a pendulous abdomen and a slightly forward-leaning carriage.

Llamas come in a range of colors and body shapes although these differences are just variations in type and not of breed. Llamas may be brown, red, black or white or a combination of these colors. Llamas can be short, broad and woolly or tall and large-framed with short wool. There is no specific nomenclature to refer to different classifications of llamas other

than males, females and babies. Breeding males are sometimes referred to as studs and babies as *crias* (Spanish for baby). Neutered males are called geldings.

Llamas are generally healthy, thrifty animals. A llama requires 10 to 20 percent of the feed of a horse. Llamas are most often compared to horses because of physiological similarities. Llamas are quite efficient in using available forages. They can use a much lower grade forage than most ruminant species. They can maintain condition by foraging on low-quality range on about 5 percent of the area required by a horse. Llamas tend to be browsers, eating a small amount of forage intermittently. This feeding characteristic prevents them from being poisoned by ingesting toxic plants. Llamas' inherent hardiness helps them withstand extremes in feed quality and climate. The notable exception is extreme heat combined with high humidity. These types of conditions can adversely affect fertility and general health causing the animals to exhibit heat stress.

Llamas are markedly territorial. The animals originate from relatively low-productive, fragile environments where even small increases in animals above the carrying capacity can have grave consequences for the entire herd. This background probably explains male llamas' unrelenting aggression against invading males, excess breeding females and weanling-age young. Invasion of territory by another llama results in a series of posturing gestures. If the intrusion continues, the resident of the territory may spit at the intruder. Conflict is usually settled at this point between females; however, males often continue into physical contact by biting, kicking and ramming into each other. The fighting between males is a rather noisy affair of screaming and squealing, reminiscent of stud horses fighting.

Feeds and Nutrition

Feeding options for llamas are virtually unlimited, providing for many possible combinations of roughages, concentrates and commercial supplements. The predominant factors which enter into the decision of what to feed include feed cost, availability of feed, nutrient balance and energy density required. Young llamas, which are still actively growing, require a greater concentration of nutrients than mature animals because of their relatively smaller digestive tract capacity. Table 1 provides estimates of daily consumption of bromegrass hay, alfalfa hay and corn silage needed for maintenance. Dietary requirements will be different based on animal performance desired, work performed and weather conditions. A 300-pound llama will need about four pounds of alfalfa hay (90 percent dry matter) per day to maintain condition (Table 1).

Llamas adjust well to free-choice feeding or once-a-day feeding schedules. Most llama owners set up a feeding schedule based on owner convenience. Potential llama owners need to be aware that adult llamas on free-choice feeding (*ad lib*) may become fat, depending on the quality of feed being offered. Therefore, adult llamas may require limits of high-quality feed.

Table 1. Estimated daily requirements of bromegrass hay, alfalfa hay and corn silage on an as fed and 100 percent dry matter basis for llamas from 22 to 550 pounds

Body Weight	Bromegrass		Alfalfa		Corn Silage	
	As Fed	Dry Matter	As Fed	Dry Matter	As Fed	Dry Matter
	pounds					
22	0.8	0.7	0.5	0.5	1.5	0.4
44	1.3	1.1	0.9	0.8	2.6	0.7
88	2.1	1.9	1.5	1.3	4.3	1.2
110	2.6	2.3	1.7	1.6	5.2	1.4
165	3.4	3.1	2.3	2.1	6.9	1.9
275	5.0	4.5	3.4	3.1	10.1	2.8
385	6.4	5.7	4.3	3.9	12.9	3.6
495	7.8	7.0	5.3	4.8	15.8	4.4
550	8.5	7.6	5.7	5.2	17.0	4.8

Source: Fowler 1989.

Reproduction

Llama males are considered sexually mature at 2.5 to 3 years of age. However, there have been reports of males as young as 6 months of age causing pregnancy. Males are generally not considered reliable breeders until 3 years of age. On the other hand, properly fed and well-grown females may be bred at 12 to 13 months of age. Llamas are copulation-induced ovulators. This means that mature nonpregnant females should mate in the presence of a sexually mature male and will ovulate within 36 hours of mating. Since llamas have no heat cycle, artificial insemination is not used. Gestation period for llamas is about 344 days, which is similar to female horses. In North America, llama males are generally not used to the extent of their servicing capacity, because of limited numbers of llama herds. In Peru, under pasture mating conditions, mature males are stocked at 3 percent of herd size. Female llamas giving birth without major complications or post-partum infections will usually rebreed again within 2 to 4 weeks. Female llamas will generally have only one young, rarely twins.

Crias usually struggle to their feet within a few minutes of delivery and can be standing within a hour. The female will nuzzle and "hum" to the *cria*; however, she will not lick or clean it. The *cria* should nurse within four hours. If the young llama has not nursed within six hours, the owner should milk the colostrum (female's first milk) from the mother and bottle feed the young to get it off to a healthy start.

Diseases and Parasites

Llamas are quite hardy, although they are susceptible to many of the same diseases and parasites as cattle and sheep. The most notable disease which infects llamas is enterotoxemia, "overeating disease," types C and D. This disease most often infects young *crias*. Veterinarians report success in decreasing the incidence of enterotoxemia through immunization of the female and subsequent immunization of young at 4 to 6 weeks of age. Llamas may also be subject to tuberculosis, Johne's disease, anthrax, malignant edema and tetanus.

Llamas can be infected with internal and external parasites. Internal parasites of concern include gastrointestinal nematodes, lungworms, meningeal worms, tapeworms and flukes. These parasites can be eliminated with medicines currently used to treat cattle and sheep. External parasites (ticks, mites and lice) can be treated with pesticides approved for use on cattle.

Marketing

The predominant market for llamas in the United States is the pet market. Other outlets or uses which are gaining exposure include mountain packing, the tourist industry and guard animals in sheep flocks. A rather small market is available for llama wool. The llama industry did attract a great deal of speculation in the late 1980s which led to an increase in the variability in price of brood stock. The market has recently retraced its earlier gains and is projected to remain relatively stable at current levels. Two factors which could turn the market down include increased speculation or a large importation of llamas. The speculative market is less likely to exert pressure on prices, as the number of llamas has increased beyond the novelty or "flash in the pan" phenomenon. A large increase in the number of imported animals is unlikely. Currently, United States policy dictates a lengthy period of quarantine because of foot and mouth disease. Foot and mouth disease is highly contagious, and the quarantine period is prohibitively expensive; therefore, only a small number of animals are imported.

More than 1,300 llama breeders are in the United States and Canada. The International Llama Association is the best source for a list of llama breeders in the United States and Canada. However, many breeders advertise in local newspapers and/or radio. If llama breeders are not interested in advertising, llama auction sales are held throughout the United States. The greatest number of auctions are held in the spring and fall.

Other excellent detailed publications about llamas are "Llamas," P.O.Box 100, Herald, CA 95638 (\$25/year); "Llama Banner," P.O.Box 1968, Manhattan, KS 66502 (\$24/year); "Llama Life," 925 W. Culver, Phoenix, AZ 85007 (\$16/year); and "The Llama Link," Drawer 1995, Kalispell, MT 59903-1995 (free or donation of \$12).

Economics

Bred females sell for \$2,000 to \$3,000, while stud-quality males sell for \$1,500 to \$5,000. Llamas sold on the pet market may bring \$200 to \$500 per head. Depending on size, blood lines, breed characteristics, sex and color, yearling llamas may bring \$500 to \$5,000 per head. Expected selling price for each classification and production coefficients used to develop a llama enterprise budget are shown in Table 2.

Table 2. Production coefficients for an established 15-head breeding herd for pet llamas, North Dakota, 1993

Herd size-females	15
Males per herd	1
Mature animal death loss (%)	1.00
Cria death loss (%)	2.00
Culling rate (%)	10.00
Weaning rate (%)	90.00
Bred female value per head	\$2,500.00
Mature stud value per head	\$1,500.00
Stud salvage value	\$200.00
Cull female price	\$200.00
Yearling llama selling price	\$1,100.00
Machinery investment	\$10,000.00
Fencing investment	\$4,000.00
Buildings investment	\$6,000.00
Alfalfa-grass hay price (ton)	\$65.00
Corn price (bu)	\$2.30
Mineral price (ton)	\$240.00
Pasture rent (AUM)	\$10.00
Days in drylot	185
Roughage per day per mature animal in drylot (lb)	8
Roughage to winter mature female-6 months (lb)	1,480
AUMs per pair (female and cria) for 6 months	1.2
Corn grain per mature animal (bu)	3.25
Minerals per year per mature animal (lb)	24

A 15-head llama herd was assumed to require a \$20,000 investment in fencing, buildings and machinery. Fence which is adequate for cattle will work for llamas. Llamas can be fenced with barbed, woven or electric wire. A three-sided open-faced pole shed will provide all the protection llamas require. For purposes of this analysis, investment in a 15-female and one-male llama herd was \$39,000. Depending on existing machinery and facilities, the amount of investment needed may be substantially different.

Economic and cash flow budgets per llama female and for the herd are shown in Table 3. The budgets were developed assuming 50 percent external financing (debt) at 9.75 percent interest. The opportunity cost of equity capital was 4 percent. Breeding expense was calculated as depreciation and maintenance of the stud. The stud was assumed to be used for five years. Buildings, facilities and equipment were depreciated over 10 years with no salvage value. It was assumed that buildings, facilities and equipment were partially depreciated prior to use for llama production. Female llamas were depreciated over 15 years with an estimated \$200 salvage value. Interest on variable costs was estimated to accumulate over 12 months. Ownership costs in the economic budget include the opportunity costs of equity capital (4 percent). The cash flow budget only includes interest owed on debt capital. Insurance was included at 1 percent of breeding herd value.

Table 3. Economic and cash flow budgets for a pet market llama herd, North Dakota, 1993

	Economic		Cash Flow	
	per female	per herd	per female	per herd
Returns				
Yearling crias	\$847.00	\$12,705	\$847.00	\$12,705
Cull females	20.00	300	20.00	300
Gross Revenue	\$867.00	\$13,005	\$867.00	\$13,005
Variable costs				
Feed	\$113.75	\$1,706	\$113.75	\$1,706
Veterinarian, medical and supplies	19.00	285	19.00	285
Breeding expense	20.67	310	20.67	310
Utilities and fuel	4.95	74	4.95	74
Interest	10.89	163	7.72	116

Total Variable Costs	\$169.26	\$2,539	\$166.09	\$2,491
Fixed costs				
Machinery ownership	\$45.83	\$688	\$32.51	\$488
Building and equipment ownership	27.50	413	16.00	240
Breeding stock ownership	178.75	2,681	126.75	1,901
Depreciation on fixed assets	133.33	2,000	xxx.xx	xxxxx
Depreciation on breeding stock	153.33	2,300	xxx.xx	xxxxx
Insurance	26.00	390	26.00	390
Total fixed costs	\$564.75	\$8,471	\$201.26	\$3,019
TOTAL LISTED COSTS				
Returns over variable costs	\$697.74	\$10,466	\$700.91	\$10,514
Returns to labor, equity and management	\$132.99	\$1,995	xxx.xx	xxxxx
Cash flow (debt repayment and family living)	xxx.xx	xxxxx	\$499.65	\$7,495

Note: Budget developed under assumption of 15-head herd.

The economic budget is generated by charging market rates for all resources needed for production. It helps answer the question "Is this enterprise profitable?" The bottom line represents a return to labor and management.

The cash flow budget is an estimate of the out-of-pocket cash needed to run the enterprise, including not only direct costs but indirect cash costs such as principle and interest payments, insurance and taxes. It helps answer the question "Can I meet my cash obligations if I go into this enterprise?" Total cash expenses are subtracted from total cash receipts to calculate the net cash which is available for family living and other needs.

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Rocky Mountain Llama Association, 593 19 3/4 Road, Grand Junction, CO 81503. Ph. (303) 241-7921

Wells, Gene and Jan. Owner/operators of "Horseshoe Valley Llamas." Rt. 5, Fergus Fall, MN 56537. Ph. (218)736-4707.

Funds to support the research for and production of the Alternative Agriculture Series were made availalbe to the Value-Added Agriculture project by "Growing North Dakota" legislation through Technology Transfer, Inc.

Alternative Agriculture Series, **Number 12**, August 1993

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