

A Different Sort of Sheep

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The morning frost is just beginning to melt from the yellowing grass tops. A lone Peruvian herder, bundled in wool, pushes his animals down a steep rocky trail. The animals have been pastured at 17,000 feet for the last 3 months. The rainy season begins soon and they must be driven to lower pastures near the village at 14,000 feet. At these extreme elevations, little cultivation of crops is possible, thus highland Indians depend primarily on a special breed of "sheep" for their livelihood.

The high mountain "sheep" of South America are a unique domestic breed. In fact, alpaca are not really sheep at all! They are members of the camel family, which consists of the genus *Lama* in the New World and the genus *Camelus* in Asia and North Africa. Alpacas, along with llamas (pronounced ya-ma), are the only domestic ungulates native to South America. They are grazed primarily in the high Andean mountain region of Peru and Bolivia known as the "Cordillera."

Paleontological finds indicate the common origin of the South American Camelidae and their humped-back relatives was probably 16 million years ago in North America. During the late Pliocene, ancestors of the Dromedary and Bactrian camels migrated north and crossed the Bering land bridge to the Old World. With the coming of the Pleistocene ice age, North America lost its camels, yet the "Hemiauchenia", ancestor of today's genus *Lama*, escaped extinction when it migrated across the Panamanian isthmus into South America where relatives survive today. At present, all llamas and alpacas are domesticated, but the other members of *Lama*, the guanaco and the vicuna, still exist in isolated wild populations.

Selective breeding of alpacas and llamas by native South Americans may have occurred as early as 4,300 B.C. Certainly by 550 B.C. alpacas were being bred for wool production and alpaca textiles were transported from the mountains to the southern coast of Peru. The culturally advanced Inca empire (1,200-1,532 A.D.) relied extensively on the llama and alpaca for transportation of armies and goods, and for fiber production. Today nearly 2.5 million alpacas graze South American highlands.

There are two distinct breeds of alpaca: the "huacaya" and the "suri." Huacaya, the more common breed, has highly crimped wool similar to that found on Lincoln sheep. By comparison, suri wool is relatively straight with little crimp. Selective breeding favoring one breed over the other is rare,



Alpacas grazing at 14,000 feet in the Andean mountain region of Peru. (photo by Brad Wilcox).

although huacayas are more common, especially in colder climates. Huacayas may be better adapted to cold because in the suri breed, the fleece hangs from the body, thus exposing the back.

Both alpaca breeds are similar in size. The average height is about 39 inches at the withers with males (machos) weighing around 155 pounds; females (hembras) average 132 pounds. Alpacas, because of their small size, are never used as pack animals.

Alpaca Products

In 1980, over 3,400 metric tons of alpaca wool were produced in Peru. The wool is incredibly soft and fine, the normal range for adult wool being about 22 microns in diameter. In comparison, Lincoln sheep wool averages 35 microns in diameter. Wool colors range from black through beautiful intermediate shades of brown and rust to pure white. Diversity of natural colors and superb insulation make alpaca wools world renowned.

Peru exports about 80% of its alpaca fiber. England, Italy, and West Germany are the major buyers. Traditionally, white wool has had higher market value because of its dyeing versatility. The average price for white alpaca wool in the 1980 Santa Lucia, Peru, market was 6 times that paid for sheep wool.

Along with the importance of alpaca wool production, a

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Editor's Note: Many feel that international development is an important extension of the Society's interest. This article should add to that interest.

major food for highland Indians is alpaca meat. Around 10,000 metric tons of alpaca are consumed yearly in Peru. When cooked with alpine potatoes, the major Andean vegetable, alpaca makes a delicious and nutritious dish.

A third product of alpacas is "taquia," dried camelid dung. Since most of the alpacas and llamas range is treeless grassland, dung is an important fuel source for cooking and heating. The excrement is pellet-shaped and can be gathered efficiently because alpacas and llamas "thoughtfully" use common voiding places. With forced air, alpaca dung fires can even reach sufficient temperatures to forge metals.

Adaptations to High Altitudes

Animals living in alpine environments must be able to survive extreme conditions such as radical temperature fluctuations, low food quality, dehydration, and lower oxygen. It is not surprising that South American camels have adaptations for dealing with life nearly 3 miles above sea level.

Circulatory System

Low oxygen of high altitudes is thought to have brought about specialized adaptations within the circulatory system in alpacas. The red blood cells of all camels have unusually concentrated hemoglobin, are smaller in size, and are more elliptically shaped than those of other ungulates. This

arrangement increases the surface to volume ratio of the cells, allowing for greater binding of oxygen. The blood of llamas was found to saturate with 30 percent more oxygen than that of man at high elevations. Packed with loads of over 75 pounds, a llama will untiringly climb steep alpine trails with surefootedness and grace.

Digestive System

Peruvian alpine forages such as *Calamagrostis vicunarium* and *Festuca rigescens* are generally poor in quality due to high lignin concentrations. Lignin, mostly a nondigestible substance, is an important component of a plant's defense against harmful ultraviolet radiation of high elevations. Animals grazing alpine pastures must be capable of processing coarse, heavily lignified material. Due to the distinct Andean "wet" and "dry" seasons, alpacas must cope with dry mature forage for over 6 months of the year.

Several studies indicate that alpacas are more efficient digestors of this type of vegetation than either sheep or cattle. A digestibility trial conducted with 3 sheep and 3 alpacas showed digestion coefficients of 29.7% and 36.3%, respectively, for animals eating *Scirpus* sp., a coarse aquatic sedge.

A number of studies describe morphological and physiological differences between camelids and other ungulates which may help explain why camelids appear to be superior digestors of forages. Alpacas are ruminants in the strict sense of the word, that is they chew a cud; however camels evolved separately from other ruminants and their stomach is not clearly divided into four separate compartments. Camels have only 3 major stomach compartments.

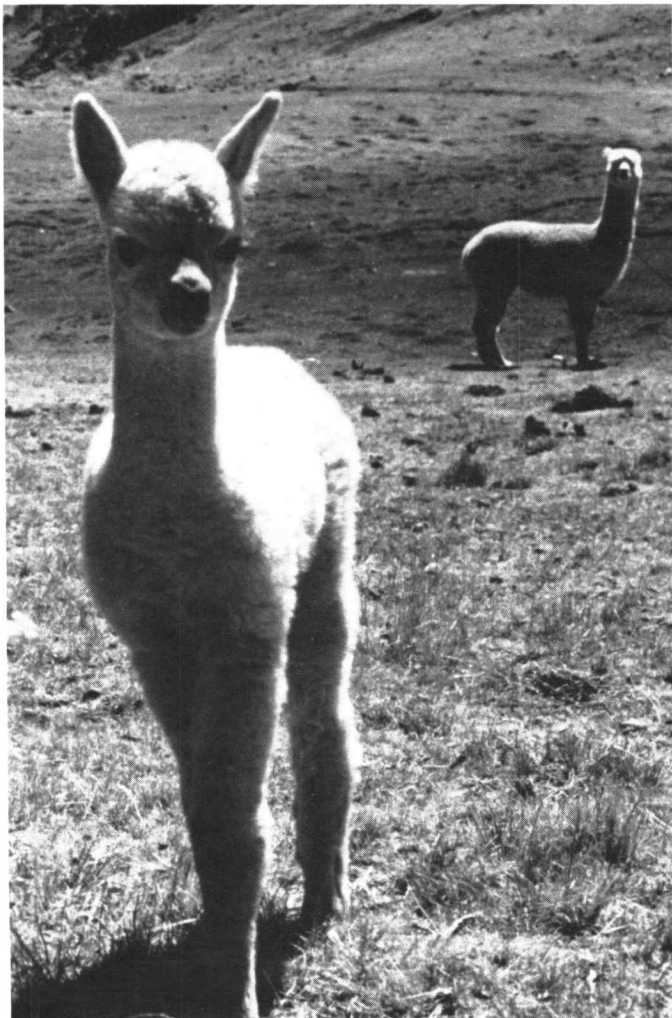
Further, the stomachs of camels appear to function similar to other ruminants except that in camels, the muscular contraction cycles of the stomachs "stir" digesta more frequently. Another significant difference is that the first stomach of camels is lined with specialized glandular pouches. The function of this lining has been suggested as a site for rapid absorption which could act to increase digestive efficiency.

It is believed that South American camels consume less forage per body weight than sheep or cattle. In a study where llamas and sheep were fed alfalfa ad libitum, llamas consumed 2.1 percent of their body weight per day and sheep consumed 4.3 percent. Lower consumption per body weight is likely related to slower passage of ingesta through the alimentary tract of alpacas. The average passage time for marked digesta through the gastrointestinal tract of alpacas in one study was 50.3 hours compared to 43.2 hours for sheep.

Reproductive Peculiarities

Alpacas are polygamous, but unlike sheep they are copulation-induced ovulators (as are rabbits and cats). This means that the female has no defined estrual cycles but will ovulate 24-36 hours after copulation. Females can give birth at any time of the year but breeding seasons are timed with the short "wet" season. Alpacas are well adapted to this wet season phenomenon with a gestation period of roughly 1 year (340-350 days). This enables births to occur when forage is green, nutritious, and plentiful.

Alpacas are not usually bred until they are 2 years old, although they are sexually receptive at 1 year. Breeding ratios are normally between 5-10 females per male. Following copulation and subsequent ovulation, estrus disappears



Young "crias" are usually born in the early morning, after day-break. The above are 10 days old. (Photo by Brad Wilcox).

within 5 days. If fertilization does not occur, follicles again become active and estrus can be observed within 13 days. The absence of estrus is a diagnostic sign of fertilization.

Although alpacas have bi-chornate uteruses, 98% of all pregnancies are carried in the left uterine horn. There are no records of twins. As in humans, the placenta is diffuse and is expelled 2 or 3 hours after parturition. Unlike sheep, alpacas do not eat the after birth and seldom clean the embryonic sac off their young. The young (crias) are well developed and can walk shortly after birth. Mothers are not very attentive of their young but they will become aggressive when the young are interfered with. Like the Old World camel, her major weapon is to spit with great accuracy and velocity.

Amazingly, birth almost always occur in daylight hours! Sleepless nights our ranchers face with midnight calving or lambing is unheard of in the Andes of Peru. Even more incredible is that most crias are born in the morning rather than the afternoon and seldom during bad weather. Apparently, alpacas are able to delay the act of delivery under unfavorable conditions. Daylight parturition is likely an adaptation to avoid giving birth during the freezing nighttime temperatures of high altitude regions.

New Research

Up to this point, we have painted a fairly bright picture of

truly unique wool-producing animals. Unfortunately, the highland Indian populations of South America are rapidly growing and are economically some of the poorest inhabitants of the continent. Alpacas, over much of their range, suffer from disease, impaired wool production, and low fertility. These conditions are commonly attributed to poor nutrition due to overgrazing and improper herd management.

Improving alpaca nutrition appears to be the key to improving animal production. Adequate nutrition must first be present before improvements in herd genetics or advanced disease control would have substantial effects. Surprisingly, range nutrition has been largely ignored in past research efforts.

In 1978, Texas Tech University, in cooperation with U.S. Agency for International Development and Peruvian universities, began a project to investigate ways of increasing alpaca production. An important phase begins in 1983 with an effort to collect information on the nutrition of free-ranging alpacas in Southern Peru. It is hoped that cooperation between North and South American scientists will improve production guidelines for this different sort of sheep.

SOCIETY FOR RANGE MANAGEMENT

yards now meters
academia rules
none of this
will help me
run my ranch

science is weak
not quantitative
still descriptive
after all these years
ranchers run the society

we need
to influence policy
become politically involved
we must
be scientists
analysts not advocates

we cannot agree
but the land
unites us

16 February 1983

CONVENTION PROGRAM

i search for me
among forage alternatives
promising range grasses
performance of range cows
a rangeland model
burning of sacchuista
and orange sneezeweed
do not reveal me
seasonal use of tobosa
stocking rate predictions
morphological considerations
of brush control
i am not there
i'm listed
on page seventeen
for opening remarks
in the Lisbon Room
i still can't find me
even though
i'm scheduled to perform
on Tuesday afternoon.

16 February 1983

REUNION

familiar faces
obscured by
beards
bags
wrinkles
glasses
name tags
print
I cannot read
memories
of dogma taught
trivia not trivial
I try to recall
events
people
places
things
I stare
at a man
they think I was
try to explain
who I think
I am
wonder when
where
or even if
we went astray.

16 February 1983