



Llama Wool

International Llama Association Educational Brochure #9

Fiber History

For centuries man has looked to wool for a source of warmth in clothing and blankets. As trade routes opened from Asia, exotic fibers found their way to Europe. Angora goats, producers of mohair, originated in Asia's Himalayan mountains and migrated with their nomadic herdsmen to Turkey. They are named after the province of Angora, Turkey. The Kashmir goat whose fine undercoat produces cashmere, got its name from the Kashmir region of India. It still makes its home in the central Asian countries, with the best quality fiber coming from China. The camel has been used for centuries in the deserts of Africa and Asia for transportation as well as wool. The world's finest fiber, musk ox, is rarely available, though in 1954 an effort was begun to reestablish their numbers in Alaska.

South American llamas and their relatives, romantically nicknamed "Camels of the Clouds," are native to the Andean mountains and include llamas, alpacas, guanacos, and vicunas. As early as 1628 a Spanish chronicler wrote about "Peruvian Sheep," describing them as small camels.

Today as in pre-Incan times, the multi-purpose llama is highly revered by Andean Indians who make use of everything from its hair to its droppings. Llama charqui (jerked meat) nourishes them, its fleece keeps them warm, the hide is used for crude sandals, the long guard hairs for ropes, and burning the *carbon peruano* (dried excrement) wards off the chill of the high country.

The Incas were not the first to take breeding for wool seriously. The earliest recorded application of genetic principles is aptly described in Genesis 30 where Jacob separated colored sheep from white, selecting only the strongest animals from his father-in-law's flock for his own. In the Andes, llamas and alpacas were domesticated over 5,000 years ago, though their exploitation in the advancement of a great civilization didn't occur until the 11th to 13th centuries. The rules and regulations of Inca llama herd management are ranked among the top in the annals of world animal husbandry. Their immense llama and alpaca flocks were thoroughly classified for uniformity in age, sex, and color on "quipu," a ledger made of knotted strings. As a result of the Spanish conquest, however, many of the Inca herd management programs were abandoned.

In recent years steps have been taken to improve wool quality and production in South America through the establishment of private and government breeding ranches.

Physical characteristics

The llama is a two-coated animal. Its fine, downy undercoat gives protection from cold and heat. The second coat of crimp-less guard hair allows moisture and debris to be shed. Llama fleece varies from 0-20% guard hair. In North America today, many llamas have a coat more like the alpaca (who historically has been selectively bred for fineness of fiber, and has lost both the hair coat and the ability to shed). While the altiplano offers Andean llamas as little as 2% protein, every North American breeder has access to the 8-16% protein ration recommended for a regular maintenance diet, as well as vitamin and mineral supplements.

The fiber of llamas and alpacas varies greatly from individual to individual. (Though we refer to it as wool, what grows on llamas and alpacas is technically a hair because of its cellular composition.) Magnified cutaways show that it is a somewhat tubular hair with a medullated, or hollow, core, structurally different from the solid or corticated fiber of sheep and most other wool-bearing animals. The degree of medullation decreases with fiber diameter, with the finest llama and alpaca fiber having an interrupted medullation, or none at all. This unique structure may account for the remarkable warmth and insulating quality of camelid fiber, and contribute to its tensile strength and durability.

A study by F.H. Bowman shows the following relative strengths of fibers:

Human hair	100.0	Australian Merino	122.8
Lincoln wool	96.4	Mohair	136.2
South Down wool	62.6	Alpaca	358.5

The Inca civilization could likely not have thrived at its high, harsh altitude without the warm fleece of these native animals. While the exquisitely soft wool of the vicuna was reserved exclusively for Inca nobility, shorn llama wool was placed in public warehouses and doled out to Indian families for fabrication into the common man's cloth. Because it was coarser than alpaca, llama wool was used mostly for utilitarian items such as outer clothing, blankets, ropes, and sacks used for packing. Then and now, alpaca is used primarily for clothing.

Today, with the popularity of our woolly friends growing throughout North America, a closer look at what Mother Nature has given us in llama fiber and what we can do with it is needed. The wool is remarkably light and warm, sheds rain and snow, and comes in an array of natural colors. Unlike sheep wool, it shrinks little during washing or processing. The grease or lanolin of sheep wool accounts for 30-40% of its weight. Because llama hair lacks natural oils, it is very light and thus has 90-93% yields.

With selective breeding and good diet we have been able to improve the coats of many North American llamas, with some comparing in fineness and length to alpaca.

A fiber study at La Raya, Peru shows that age and breeding status also affect wool production in alpacas and llamas. In females, wool production levels off when they begin reproducing or at about three years of age. Male wool production accelerates until seven years of age. Fiber diameter, measured in microns (1/1000 millimeter or 1/25,000 inch), ranges from 20 to 40 for llamas in South America. Wool samples from 39 U.S. llamas tested by the University of California at Santa Cruz during the 1984 ILA conference in that city averaged 20-22 microns in diameter. By comparison, sheep wool measures from 12 to 39 microns, with Merino being the finest.

The World's Finest Fibers

The British Wool Marketing Board uses several tables, including the Bradford Count, to determine wool quality. These tables include fineness, staple length, presence of outer hair, luster, crimp, vulnerability to chemical damage, etc. For our purposes we are using only the fineness chart which gives the diameter of the fiber in microns (1 micron = 1/1000 millimeter). The information below is from the British Wool Marketing Board and other sources.

Animal	Fiber Diameter (in microns)
Vicuna	6-10
Alpaca (Suri)	10-15
Musk Ox (Qiviut)	11-13
Angora Rabbit	13
Cashmere	15-19
Yak Down	15-19
Guanaco	16-18
Merino	12-20
Chinchilla	21
Mohair	25-45
Alpaca (Huacaya)	27.7
Llama (Tapada)	20-30
Llama (Ccara)	30-40

Not only did the Incas have some of the world's finest fibers to work with, but they had astonishingly sophisticated hand spinning and weaving techniques. Pre-Incan woolen goods found in the Lake Titicaca area have a weft count of 190-240 threads per inch which, amazingly, is finer than our finest percale sheet today. Other ancient samples show vicuna mixed with the hair of bats and the viscacha, a large chinchilla-like rodent of the high puna. A vicuna sheared annually produces just 6-8 ounces of wool.

Harvesting or Collecting Wool

Methods of collecting wool vary from person to person. Many have discovered that a commercial blower or leaf blower make quick work of removing dust and debris. A wire brush such as a dog grooming brush is often used to remove more stubborn debris.

After this initial cleaning, llamas, like sheep and alpacas, can be shorn, clipped or brushed. Brushing removes primarily the fine, luxurious undercoat next to the body. Shearing and clipping take both the down and the coarse, outer guard hair. It's important to leave at least 1-2" of wool on the animal to prevent sunburn.

The type of restraint used will depend on the animal's temperament.

Shearing Although spring shearing isn't popular in the U.S., it efficiently gives the greatest yield. Shearing should be done in a clean area, or over a tarp. For an amateur, fewer second cuts (the shorter fibers caused by shears passing through wool in the same area twice) will occur if the animal is hand-shorn rather than using electric shears. Shearing is not recommended for animals

with a heavy coat of guard hair because, unless it is de-haired in processing, the yarn will be quite itchy as the coarse hair ends poke out rather than blending in.

Llama fleece normally grows 3-4" per year. A full-grown coat averages 5-10 pounds, with exceptionally woolly, mature, unshorn animals bearing as much as 20 pounds. If shorn, it takes two years for most normal coats to grow back.

Clipping Clipping is easier than shearing for a novice, and doesn't produce as drastic a visual change. It is especially useful if wool is matted or too thick to brush through, and will yield a blend of guard hair and down. If several animals are to be clipped, hand shears are a good investment (around \$30). If not available, scissors will do.

One method is to start by securing a 4" row of wool down the back ridge with clothespins, large hair clips, etc. This ridge will be left to hide the uneven cut rows and prevent sunburn. Cut below this ridge in 1" horizontal layers from withers to rump. Continue in this manner until one side is completed. The fleece will stay together and peel down as you go with the exceptions being a very clean (show-groomed) or very young animal. Repeat on the other side. Release the secured ridge and brush down.

Brushing This method is time consuming but yields a much softer, finer, yarn than methods which also collect the guard hair. Most easily, done when the animal is shedding, brushing is a wonderful way to really know your llama, who will benefit from the handling. Cosmetic winter brushing will not interfere with the insulating function of the wool. The annual yield from brushing averages 3-4 pounds, but ranges from 2-8 pounds.

Preparation

Before the wool can be spun for use, it must be cleaned - and the cleaner the better. Most communities have specialty shops where the various tools for wool preparation are available. A variety of helpful publications are listed in the bibliography. The neck and leg wool from animals with shorter, coarser hair in these areas should be discarded.

Hand Picking This is done by teasing small amounts of wool with fingers so dirt and vegetation falls out. It takes time, but spinning directly from hand-picked wool creates a wonderfully textured, natural or rustic thick/thin type of yarn. Some like to hand pick the wool before carding.

Hand Carding Carding is done to open fiber, remove debris and second cuts, and arrange fibers so they are easily drafted, or drawn out, during spinning. The use of hand carders (flat or slightly curved wooden paddles with closely set rows of short, metal teeth) is time consuming but produces a fine, even yarn that is easy to work with.

Machine Carding Passing fiber between two cylindrical drums covered with metal teeth produces a batt of carded fiber. Ranging from 6" wide hand-cranked to 12" wide electric models, these machines vary in effectiveness because of the wide range of cloth coverings used on the drum. The most effective is one with closely set teeth which remove a great deal of dirt and debris and best align the fine fibers. The remaining vegetation is evenly distributed throughout the finished batt. The cleaner the wool before carding, the better the end product. Hand picking prior to carding is recommended.

Mills Some mills process llama wool, however, keep in mind their equipment is so large that the handling of small amounts is impractical. The end product depends on the quality and cleanliness of the wool they receive. Wool with lots of debris will come back with much of it ground up and evenly distributed throughout.

Some mills will de-hair llama fleece as is done with cashmere. By request, they may also blend llama with silk, mohair and other fibers. Some spinners find that mixing in a small amount (10-33%) of lamb or other fine wool improves the end product by increasing manageability and preventing cling in the rollers. Prices for commercial processing vary depending on mill and quantity.

The finished product will be returned to you in "batts" which look like quilting batts, in roving, or in a coiled sliver which looks like loose rope. The yield can be as little as 50% of the original weight depending on the quantity and cleanliness of the wool sent for processing, and the size of the machinery.

Hand Spinning & Uses

Prepared llama wool is a spinner's delight - clean, odorless, greaseless, and light. The finished yarn depends on the spinner. It can be very textured, or smooth and fine. I prefer working with pure llama wool that is not blended with anything, but novices will find a blend of llama with 15-25% good quality sheep wool easier to begin with.

Your selection of a spinning wheel depends on many things. Prices range from under \$100 for a kit to several hundred for elaborate wheels. When choosing one, remember that you want it to work for you and not just be a decorator piece. Try to visit shops that offer more than one brand, and test them. Paula Simmons (1977) has quality drawings of 77 wheels with statistics on each, and does an excellent job of explaining wool processing equipment and how to weave.

I hand wash the spun wool in a mild dishwashing liquid or shampoo, attach weights and hang it until almost dry before removing weights to set the twist.

After spinning, you are limited in the creation of a finished piece only by your imagination. The natural colors work will together, can be plied for tweeds, or dyed any color of the rainbow. I recommend a 2 ply for knitting as it gives ribbing on cuffs and the bottom of the garment greater durability. Spun wool can be woven into yardage for use in shawls, jackets, skirts, shirts, blankets, vests, and more. Mill-carded llama wool also makes a superb quilt batt.

At the present time in North America this wonderful fiber supports a number of cottage industries. However, until our llama wool harvest is much greater or is cooperatively collected, it is doubtful that it could be processed on a large, commercial basis here.

Your Involvement in this creative industry can be as simple as owning one animal, hand carders, a drop spindle, and a pair of knitting needles, or can be expanded into a full-fledged home production line with pickers, carders, spinning wheels, and looms. It's exciting to explore the possibilities, led by whatever tickles your fancy and imagination.

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