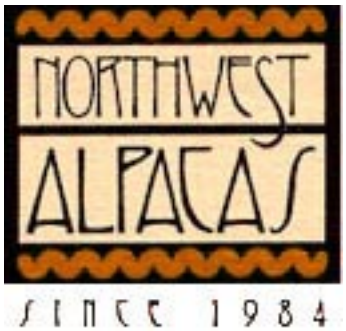

A Look At The 50/50 (Fleece Vs. Conformation) Alpaca Owners And Breeds Association Show Rules

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By Mike Safley

The Alpaca Owners and Breeders Association (AOBA) established the first North American show rules in 1990. They decided not to adopt breed standards. The first "weighting" of the show rules established that alpacas should be judged 45 percent on conformation, 45 percent on fleece, and 10 percent on alpaca type. The rules were later amended directing judges to allocate 50 percent to fleece and 50 percent to conformation when making their placing decisions. There was an effort several years ago to allocate 60 percent to conformation and 40 percent to fleece. The new international show rules allocate 60 percent to fleece and 40 percent to conformation. The AOBA Board of Directors (BOD) recently sent a letter to the membership saying that the 50/50 rule, as it has become known, is sacred.

When I received the AOBA letter I asked myself, why? As most breeders know, in Peru, judges base their decisions on 70 percent fleece and 30 percent conformation. Australian judges base their alpaca placings on a 60/40 basis. Why is it "sacred" that in the United States we judge our alpacas 50/50? Why would breeders in the United States want less emphasis on fiber than other alpaca breeding nations? What if conformation components such as such as knock-knees, cow hock, or sickle hock, are not particularly heritable, but are the result of environmental or congenital conditions? I began to research these questions and you may find the answers interesting.

There are several arguments advanced for the reduced emphasis on fleece by the advocates of 50/50 show rules: 1) 50/50 is the politically acceptable ratio; 2) conformation is harder to select for than fleece; 3) fleece quality is easy to improve, and; 4) we have not been breeding the animals long enough to focus more strongly on fleece. The same people who advocate the 50/50 rule seem to argue adamantly against breed standards.

I decided to examine these arguments in the context of the show ring as a place to encourage genetic excellence in the breeding of alpacas. For us to do that as an industry, we must first decide whether alpacas should be judged as performance animals or as production animals. Next we need to eliminate politics from the formulation of show rules. I conclude this article with some specific advice about how to create and show winning alpacas.

PERFORMANCE VS. PRODUCTION

Performance animals are generally judged on their athletic ability. Examples of animals whose value is based on their performance include horses that race or jump, mules that pull, llamas that pack, or dogs that herd stock. Animals whose value is based on production include dairy cattle for milk, chickens for eggs, and sheep for wool and meat. In the world's opinion, alpacas are primarily a production animal valued for their luxury fleece.

This distinction is important to understand because we need a common goal for our show system and animals selection efforts if our aim is to create an ideal alpaca. We also need to base our objectives on a selection system that is scientifically sound. As a foundation for these decisions we need to collectively agree on breed standards that define an ideal alpaca for United States breeders. Choosing the winner at a show based on traits that are not genetically heritable is a journey down a slippery slope. There is a portion of every show system that is based on an aesthetic ideal; pretty animals win, but an effective show system should primarily recognize heritable production traits if the animal to be judged is a production animal. If we determine that alpacas are performance animals, more similar to llamas in their use, then our show rules and breed standards would be significantly different and place more emphasis on performance.

ALPACA POLITICS

Before I continue discussing the show system in the context of heritable traits and scientifically sound selection systems a word about the politics of shows and breed standards is in order. There are a number of people in our industry occupying leadership positions that are adamantly opposed to changing our current 50/50 system. Large breeders, for instance, fear standards because they may make at least some of their alpacas less valuable. Small breeders fear that all their animals will lose value if the adopted standards do not describe their animals.

I have also heard rationale on behalf of the 50/50 rule that by increasing the focus on fleece we would be favoring one region of the country over another. Many breeders who value conformation over fleece would be seen as losers in any change favoring fleece. With regards to breed standards, some judges object to adopting them, maybe because they do not want to be held to more objective criteria.

At an even more fundamental level, some breeders believe that certain traits, such as crimp, are unimportant or that straight legs are fundamental to the future of the breed. Some would have you believe the animal's bite is more affected by its age or environment than by genes. In short, we do not, as an industry, agree on the basis for excellence in alpacas. We do not have scientifically sound objective standards. Alpaca breeders in the United States stand alone in this omission. In fact, I know of no other breed that has not adopted breed standards, with the possible exception of llamas who are a performance animal.

I would suggest that this is an unhealthy state of affairs and shortsighted. This lack of standards is particularly harmful to new breeders and breeders who buy based on another breeder's subjective opinion of excellence. Without a description of commonly accepted excellence, there is no common goal to our improvement efforts, no ideal to aspire to. We need an informed debate on these issues that elevates the discussion and takes the politics out of the show ring and defines breed standards in an objective manner. Breeders should realize that there is no such thing as a perfect alpaca and they should not fear a definition of an ideal alpaca. All of AOBA's breeders should join in these decisions after informed debate.

IS CONFORMATION A HERITABLE TRAIT OR THE RESULT OF ENVIRONMENTAL INFLUENCES?

With 50 percent of the merit alpacas being judged based on conformation, it seems to me that the industry should be careful to determine that conformation is primarily passed on through an alpaca's genes. David E. Anderson, an associate professor in veterinary medicine at Ohio State University, recently wrote an article entitle *Angular Limb Deformity, "Crooked legs in crias,"* that was published in Magical Farms' January/February 2001 newsletter. Here is part of what he had to say:

"Angular limb deformities (ALD) are common among llamas and alpacas. Veterinarians most commonly are asked to examine growing neonates for skeletal abnormalities, but these defects are not uncommon among adult llamas and alpacas. Owners may perceive that a mild angulation (<5 degrees) in the forelimbs of adults is within the expected variation of normalcy. However, these angulations represent a skeletal defect and should not be encouraged as a 'normal' phenotypic trait. ***ALD may be congenital or acquired*** *(emphasis added). Congenital ALD most often is associated with prematurity. Premature neonates often have joint instability, presumably caused by immaturity of ligaments and surrounding muscle-tendon units. This results in altered weight bearing which causes eccentric loading of the physes of the limb. Physes respond to biomechanical loading by changing the growth rates within the physis. Thus, ALD worsens if the limbs do not achieve normal angulation within a few weeks of birth."*

Robert J. Van Suan, DVM, PhD, Bradord B. Smith, DVM, PhD, and Barbara J. Watrous, DVM published

the following study in *Scientific Reports* entitled *Evaluation of Vitamin D Status of llamas and Alpacas with Hypophosphatemic Rickets*. Here is what they had to say in their preamble to the groundbreaking study on crooked legs in camelids:

"Abnormal bone growth is a common problem in young growing animals of all domestic species. Rickets is a metabolic bone disease characterized by a failure of mineralization of bone osteoid and cartilage matrix resulting in visibly swollen joints, lameness, and, eventually, deformed long bones and fractures. One sequela to this disease syndrome can be angular limb deformities. Absolute or induced deficiencies of calcium, phosphorus, or vitamin D have been identified as causes of rickets…"

They studied a number of alpacas and llamas with crooked legs based on the following hypothesis:

"Our hypothesis was that a deficiency of vitamin D was the underlying cause for rickets, and the observed hypohosphatemia was a consequence of vitamin deficiency. The objective of the study reported here was to determine whether differences existed in serum concentrations of calcium, phosphorus, and vitamin D between South American camelids affected with rickets and clinically normal herdmates."

They came to the following conclusion:

"On the basis of analysis of the data reported here and that of previous reports, serum phosphorus concentration of <4.5 mg/dl in juvenile camelids that are <7 months old would be suggestive of a diagnosis of rickets syndrome, especially when other physical findings are evident. Supportive radiographic findings include physeal ectasia, cupping and flaring of metaphyses, and angula limb deformity (usually carpal valgus). ***We believed that vitamin D deficiency was the primary casual agent responsible for hypophosphatemic-rickets syndrome of growing camelids and that hypophosphatemia was only the result of vitamin D deficiency*** (emphasis added)…"

Lack of vitamin D is caused by lack of sunlight, this study suggests that crooked legs are primarily based on an alpaca's environment and nutrition, not its heredity. Remember, in Peru where most of the world's alpacas live the environment includes intense sun most days of the year.

MYTHS ABOUT CONFORMATION

An article entitled *Selecting Alpaca and Minimizing the Mistakes* published by the Australian Alpaca Association in their 2000 proceedings notebook makes the following statement. While I think the article was generally excellent, it also points out what I believe is a common myth about alpacas, i.e., that crooked legs, posture, and gait are inherited. I believe they are most often the result of congenital or environmental factors, as suggested in the above scientific articles.

CONFORMATION

"*This is an area often neglected because of lack of knowledge*.

"I personally regard conformation as the most important criteria in my selection. ***Faulty conformation is much harder to breed out than improving fineness*** (emphasis added). We *are hopefully establishing the base to a new sustainable industry. For it to succeed the base will need to be strong to carry this industry over the future years…*

"When selecting, you will often be shown animals in a small pen, most conformation faults can be checked there, but the animal will not be relaxed and might give you the wrong impression about its conformation. It is important to see the animal in its paddock so you can see it move freely. Whilst in the paddock check for balance, proportion, posture, and legs. To develop the eye will take time. If you have had experience breeding other animals it will come easier."

I have heard many times that it is "hard to breed for conformation." I would suggest to you that the reason for this is that conformation, legs in particular, is not highly or even moderately heritable. I am not saying that many conformation traits are not heritable. Size, for instance, is very heritable and based on my observation bite is heritable. Deformed ears are often evidence of a negative heritable trait and they can also be evidence of the presence of llama blood in the form of an oversized or banana shaped configuration. These ear deformities are highly heritable.

FIGURE 1: Examples Of Heritability Estimates In Dairy Cattle[1]

TRAIT	HERITABILITY
Stature	0.48
Chest width	0.27
Body depth	0.35
Angularity	0.26
Rump angle	0.29
Rump width	0.22
Rear legs, side view	0.19
Foot angle	0.27
Fore udder attachment	0.27
Rear udder height	0.20
Udder depth	0.39
Front teat placement, rear view	0.43
Teat placement, side view	0.41
Teat length	0.44

The major point that I want to make involves legs. Breeders and buyers often obsess over straight legs, as do alpaca judges. As you can see from Figure 1 above, leg set in cattle is the least heritable trait at .19, which means it is hardly heritable at all. When we speak of 50 percent conformation in our show rules, we are most often talking about leg set, i.e., knock knees, sickle hock, cow hock and the poor gait that results from these deformities. If, as the scientists have pointed out, leg faults are most often environmental, then maybe we should put less emphasis on them in the show rules. This is particularly true given that an alpaca is a fleece producing animal, as opposed to a pack animal or a racing camel.

HERITABILITY

Heritability is the strength of the relationship between an alpaca's genotype and its phenotype, that is, how strongly and consistently an alpaca's genetic makeup is expressed in its physical appearance. Heritability refers only to traits that can vary from animal to animal, and which can be transmitted from parent to offspring genetically. Heritability does not apply to characteristics that are fixed or given, such as the number of legs and eyes an animal has. On the other hand, fleece weight varies from alpaca to alpaca, so fleece weight is heritable, probably highly heritable.

Highly heritable traits are those strongly tied to genotype, the genetic makeup of the animal. By carefully selecting and breeding for the genes that control the traits, you can ensure that those traits are present in the herd's offspring, pretty much in the same degree as they are present in the parents. In alpacas most, if not all, fleece characteristics, such as crimp in huacayas or luster in suris, are thought to be moderately to highly heritable, as they are in sheep. Heritable characteristics in other species include speed in race horses, egg production in chickens, milk production in cows, and litter size in pigs (see Figure 2)

Heritability values are not applied to an individual animal's expression of a trait. They are applied to populations of animals, such as a breed. As a rule, traits with heritability values below 0.2 or less are considered marginally heritable; they are not consistently passed on to offspring. Traits with heritability values between 0.2 and 0.4 are considered moderately heritable, and can be reliable transmitted from parent to offspring. Traits with heritability values above 0.4 are considered highly heritable; they will be passed on to the offspring with a high degree of certainty. Figure 2 is a chart of the heritability values for several other types of livestock. (There have been no heritability studies done for alpacas.)

FIGURE 2: TYPICAL HERITABILITY VALUES[2]		
SPECIES	**TRAIT**	**HERITABILITY**
Cattle	Birth weight	.40
	Yearling weight	.40
	Mature weight	.65
Horses	Scrotal circumference	.50
	Backfat thickness	.40
Sheep	Milk yield	.25
	% fat	.55
	% protein	.50
	Udder support	.20
	Teat placement	.30
	Rear leg set	.15
	Wither height	.40
	Temperament	.25
	Time to trot one mile	.45
	Time to run one mile	.35
	Cutting ability	.12
	Number born	.15
	Yearling weight	.40
	Greasy fleece weight	.40
	Fiber diameter	.40
	Fleece grade	.35
	Staple length	.50

As you can see, rear leg set has a low heritability value. Production traits, such as fleece weight and fineness, tend to be moderately to highly heritable. The most highly heritable traits are typically traits that are related to size and mature body weight. If a particular trait is highly heritable, all the relatives of an animal will tend to inherit the genes that determine the trait. If it is a phenotypic trait, the relatives will tend to look alike, because they are sharing the same genes.

It will be easiest to understand heritabilities, and how they act together to influence selection response, by understanding the following example regarding fleece weight. If the average selection differential achieved across both sexes of alpacas in a given herd was 6 pounds, i.e., females with 3 pounds of fleece and males with 9 pounds and if the heritability of fleece weight at 2 years of age is 0.3 or 30%, then we could expect on average 30% of this 6 pounds of superiority to be passed on to offspring. So, in this example we would expect a 1.8 pounds improvement in the 2 year fleece weights of the next generation (0.3 x 6 lb). It is important to note that selection achieves an increase in the average performance of

[2] Bourbon, Richard M. Understanding Animal Breeding. Prentice-Hall, Inc. 1997

the next generation - it does not add 1.8 pounds to the fleece weight of every cria. It is also important to understand that the less difference there is between the animals being selected, the smaller the incremented gain. For instance, if rear leg set, side view, has a heritability ratio of .15 and the difference between the perfect leg set and a condition called sickle hock was 3 degrees of angulation then the corrective effect, if any, would be .45 of one degree. This miniscule improvement would be further complicated by the fact that acceptable rear leg angulation occurs within a range of deviation.

ARE FLEECE TRAITS HERITABLE?

As you can see from a summary of fleece heritability studies taken from a number of doctorial theses (see the bibliography) on the subject of heritabilities of fleece characteristics in sheep, fleece traits are highly heritable. I know of no studies for any fleece bearing animal that suggests that fleece characteristics are not **moderately to highly** heritable.

FIGURE 3

Estimates of the Heritability of Staple Length	Estimates of the Heritability of Clean Fleece Weight	Estimates of Heritability of Fiber Diameter
.36	.38	.33
.21	.62	.37
.35	.20	.57
.27	.58	.29
.42	.61	.80
.67	.47	.82

This does not mean that it is easy to improve fleece. Sure, if you have an old huarizo (cross between a llama and an alpaca) with 30 micron fleece, you can easily arrange a breeding that will improve the cria's fleece. With a 50% heritability for fineness you could get a cria with 25 micron fleece if you bred to a 20 micron stud and so on. But over time, try as you may, it will be hard to get a cria that gets much better than 20+ microns no matter how often you breed the cria to 20 micron males. If your goal is 17 micron fleece then you will need to start with a selection differential of between 15-16 microns and 20-21 microns. Believe me, that is difficult, not easy.

HERITABILITY AND BREED STANDARDS

I created the chart, Figure 4, below by taking the commonly acknowledged traits that are included in most, if not all, published breed standards about alpacas. The point of this chart is to identify which components of breed standards would most likely be considered either moderately or highly heritable and those that were not.

FIGURE 4: TRADITIONAL BREED STANDARD COMPONENTS AND HERITABILITY		
TRAIT	**PROBABLE HERITABILITY FACTOR**[3]	**COMMENT**
1. Head, bite, ears	Moderate to high	Ears, both defects and size, are highly heritable and, based on anecdotal evidence, bite is as well.
2. Neck	N/A	N/A
3. Forequarters	.22 - .35	Based on Figure 1
4. Body	.22 - .35	Based on Figure 1
5. Hindquarters	.22 - .29	Based on Figure 1
6. Legs, i.e., leg set, sickle Hock, cow hock, knock knees	.15 - .19	Low in all species for which the statistic is kept. See Figures 1 and 2. Most likely influenced by the environment.
7. Udder	.20 - .44	Based on Figures 1 and 2.
8. Testicles	.50	High in most all species. See Figure 1.
9. Height & weight	.48 to .65	High in all species. See figures 1 and 2.
10. Color	.50 plus	Some breeds have 100% heritability factor for color. Alpacas maybe have a similar high number, but are estimated lower due to the lack of a scientifically verified mode of inheritance.
11. Gait	N/A	Most likely affected by the environment, as it impacts leg set
12. FleeceTraits ranked in order of importance	Moderate to high.45 to .50	See Figure 3.
A. Suri		
1. Luster	N/A	Thought to be moderate to high in all sheep and mohair goats.
2. Fineness	.50	See Figure 3.
3. Density	.46	See Figure 3.
4. Staple length	.45	See Figure 3.
5. Uniformity	Moderate to high?	Finer fleece is more uniform and fineness is highly heritable
B. Huacaya		
1. Fineness	.50	See Figure 3.
2. Density	.46	See Figure 3.
3. Crimp	Moderate to high in sheep	Based on studies of merino sheep in Australia.
4. Staple length	.45	See Figure 3.
5. Uniformity	Moderate to high?	Finer fleece are more uniform and fineness is highly heritable
6. Luster	N/A	Though to be moderate to high

[3] These estimates are taken from similar estimates from other breeds. Estimates of this nature are often similar from breed to breed, but there are no heritability estimates for alpacas.

THE PURPOSE OF SHOWS

Shows are primarily a promotional vehicle. They allow an industry to promote their breed and give breeders an opportunity to promote their ranch and stock. It is a fact, right or wrong, that alpacas with blue ribbons (red in Peru and Australia) and championships sell for more than those standing at the tail end of their class. Winners are advertised and their sires are promoted, often commanding high service fees and a waiting line at the breeding paddock. The fact that show placings impact values also tend to make show systems political.

For breeders, shows are an excellent place to meet with other breeders and exchange ideas. The show ring provides an opportunity to learn about the better animals and to keep up to date on the alpacas and herds that are winning. A purchaser can learn a lot by standing at ringside. It is fun to place the class before the judge does and then try to see why the judges' placing was different than yours.

But going beyond the championship ribbons, and higher stud fees and sale prices, the show ring can be used to improve a breed. There are two ways the show ring can help breeders develop better alpacas. First, it can help keep breeders informed about the ideals of the breed. If the judges are well qualified and breeders follow the judges' preference in the selection of their stock, the show ring can be an important factor in guiding the breed's development. Second, the show ring might become effective in identifying the best animals, allowing breeders to accept show ring placing as guides to their breeding decisions. This might also have some mild effect on the genetic composition of the breed if repeated year after year, since it would encourage a slow grading-up process in the direction of the prize winners. This form of selection would favor the phenotypes most frequently favored by the judges and their approval or disapproval might help determine which animals become paternal grandsires or great grandsires of the breed. This is why we need to train our judges based on objective breed standards.

THE NEGATIVE EFFECTS OF SHOWS

Ideally, the show ring should identify alpacas according to their breeding value, but the judging process is not very effective in this regard because:

1. Important information which the breeder may know -- such as the quality of offspring, the amount of milk and fat produced by dairy cattle, number of pigs weaned by sows, length of fleece on sheep, etc. -- and which would enable the judge to make a decision about the quality of genotype, is not available to a judge.
2. The correlation between phenotype and real productiveness is low for many characteristics;
3. A very small percentage of all purebred animals are shown;
4. Considerable attention is paid to grooming, temporary conditions, and showmanship; and
5. In alpacas a lack of objective breed standards have in the past subjected the breed to subjective decisions by judges based on personal opinion, politics, and passing fads. Part of this is due to the fact that a majority of alpaca shows in the United States have been judged by judges that were initially trained as llama judges.

WHAT ARE BREED STANDARDS?

Breed standards help define the ideal animal of a given breed. Standards often evolve over time. They provide goals for breeders who are trying to improve their stock. Standards become a breeder's objective in the form of a weighted combination of traits that help define the aggregate value or merit of an animal. They are a quantification of what constitutes the ideal animal. By having industry-wide, written standards, breeders will always have a benchmark by which they can compare the individual alpacas in their herds and judges will be able to more effectively grade alpacas at shows.

DEVELOPING BREED STANDARDS

Regardless of species, the best animal should be the one that best suits the end user. When developing breed standards this is an important idea to keep in mind. Sometimes this concept gets lost in the effort to satisfy expectations that have little to do with end use. An example of distorted breeding standards can be found in the emphasis that meat and dairy cattle breeders place on a particular spotting pattern or shade of coat color. Coat color has little to do with production efficiency in these species.

Competition among breeders can also create distorted breed standards. In an effort to convince buyers that their animals are superior to those of his competitors, a breeder may find it profitable to emphasize the qualities in his animals that set them apart, even if they are not particularly important production traits. For example, if a breeder's animals are especially large, he or she may be tempted to promote the value of increased size whether or not size is inherently valuable. If their promotional efforts are successful, they will be rewarded for having large animals and begin to promote even larger animals. Pretty soon the competition will react to the success of the first breeder and the race will be on.

To avoid these arbitrary variations in breed standards, alpaca breeders should simply remember the end user. By understanding the characteristics affecting the end use of our alpacas and defining the best animal accordingly, we will all have a valuable herd improvement tool. This goal could best be accomplished by establishing industry-wide breed standards, as opposed to having individual standards that are set by individual breeders based on their respective political influence or the alpacas they have in their pasture or the size of their advertising budget.

BREED STANDARDS AND GENETIC CHANGE

If we are going to improve animals genetically, it stands to reason that we will attempt to change them. Breeders ordinarily take this to mean that they should change them in an established direction. This is where breed standards could be helpful. But should *every* trait be changed in a particular direction? Do we always want finer fleece, more milk, faster speed, or higher fertility?

The answer is clearly no, and for some traits it is easy to see why. Take, for example, the conformation trait called hock set. Animals whose rear legs are too straight are post-legged, lacking sufficient angle at the hock, and they run the risk of going lame. Animals with too much angle at the hock are sickle-hocked and can also develop soundness problems. The optimum hock set is somewhere between these extremes. The best animal has enough angle at the hock to be athletic, but not so much that it moves awkwardly. Clearly it would be a mistake to breed animals forever for increased or decreased set at the hock, particularly if this trait has a low heritability ratio. Once an intermediate optimum has been reached, there is no reason for further change. These sorts of standards should be easy to establish.

Hock set is an obvious example of a trait with an intermediate optimum. Other traits with intermediate optimum are not always so obvious. Size in dogs and milk production in beef cows are examples. The balance of fineness and density in alpacas may also be an example of an intermediate optimum. For traits like these, improvement does not necessarily mean directional change. Improvement might better be defined as an increase in the proportion of animals with optimum or near optimum performance. In other words, improvement could be the increase in the uniformity of desirable traits. This is where breed standards can be of considerable help in defining the breeders' goals.

CASH, GENETIC, AND MARKET VALUE TRAITS

To understand which of the production traits of an alpaca are important we must look at the cash market for its products. A cash value characteristic is one that is saleable or can have an immediate effect on the price of a product. Examples of cash value characteristics in alpacas are fineness, staple length, tensile strength, cleanliness, color, and degree of medullation (the absence of coarse guard hairs). These characteristics of high-quality fleece make the fleece more saleable. The marketplace creates price premiums for these characteristics; studies have determined that manufactures pay for all-natural fibers based on the criteria shown in Figure 5.

FIGURE 5: PERCENTAGE OF PRICE ATTRIBUTED BY CHARACTERISTIC	
Fineness or average diameter (FD): The primary determinant of value in the textile market is micron count	65 - 80%
Staple length: Determines which spinning system will be used, woolen or worsted.	15 - 20%
Tensile strength: Alpaca fiber is not sold based on tensile strength because it is rarely, if ever, too weak to spin.	5 - 10%
Cleanliness: Buyers of raw fleece estimate the clean yield of raw fiber when making pricing decisions.	5 - 10%
Color: Alpaca fiber is the only natural fiber which, on occasion, commands a premium based on color; historically white has been the most valuable.	Depends on current fashion
Uniformity (C of V): A uniform fleece spins finer garments with better handle	No premium currently paid
Degree of medullation: A highly medullated fleece indicates an alpaca which may have llama blood in its background or is poorly selected.	Reflected in fineness premium

In North America, the fiber industry is currently economically unimportant relative to the sale of breeding stock, but in the future, due to the laws of supply and demand, that will change. We should also aspire to be the source of the highest quality pure blood stock to other countries who, by the way, value quality fleece on their alpacas. Alpaca breeders should begin today to select alpacas for their breeding programs that will produce commercially valuable fiber, which is also consistent with the alpacas' historical use. Carefully selecting for fiber fineness, length, color, uniformity, crimp, and an absence of medullation should be important to every alpaca breeder. The relative importance of various traits to textile manufacturers is shown in Figure 6.

FIGURE 6: TRAITS OF COMMERICAL IMPORTANCE TO TEXTILE MANUFACTURERS

	Scouring & Topmaking	Spinning	Weaving	Dyeing & Finishing	Garment Manuf	Garment Appeal
Fineness	+++	++++	+++	+++	+++	++++
Coefficient of Variation	-	+	+	+	-	+
Contamination:						
Other fibers	+	+	-	+++	+	+
Non-fibrous	++++	+	-	-	-	-
Length	+++	++	+	-	-	-
Strength	++	+	+	-	-	-
Color	+	-	-	+++	-	+
Crimp	+	+	-	-	-	+
Style	++	+	-	-	-	-
Entanglement	+	-	-	-	-	-

Source: Whiteley (1994)
Note: In the chart above, a (+) indicates the relative importance of the trait, and a (-) indicates the lack of importance of a trait.

BREEDING VALUE CHARACTERISTICS

High breeding values for genetically heritable traits allow for the effective selection of cash value characteristics and purchasers pay for alpacas with these traits. Fiber fineness not only has commercial value; it also has breeding value because it is highly heritable. Density, crimp, lock structure, color, and size are other breeding value traits. Luster in a suri's or huacaya's fleece is valuable to the extent it can be passed on to the offspring. Another example is fleece weight, or fiber density, which is the result of the number of fibers growing on a given area of skin.

Density: From the breeder's point of view, density is one of the alpaca's most important production traits: The denser the fleece, the greater the weight produced by each alpaca, and ultimately, the purchase price for fiber of any grade is based on weight. It is possible that in addition to producing more fleece per animal, dense fleeces might offer better resistance to dust and help produce cleaner, more valuable fiber.

Textile manufacturers do not place any value on an individual alpaca's density, and do not offer a premium for it. However, buyers of breeding stock, for whom the trait has genetic value, do value density.

A breeder can determine an alpaca's genetic predisposition to density very simply--weigh each of the alpaca's offspring's entire fleece annually at shearing time. Alpacas that produce dense cria have high breeding values for density.

Crimp: Crimp is highly heritable in huacayas and, therefore, has a breeding value. (Suris do not exhibit crimp.) Crimp is defined as the natural wave formation of the fiber, expressed as crimps per unit of length. Visually, crimp is most notable in the well-organized staples or locks found in the fleece. Crimp also occurs along the shaft of a single fiber. (Crimp on an individual fiber has been defined by Cameron Holt, of the Melbourne College of Textiles, as crinkle.) There is a general relationship between fiber fineness and crimp in the huacaya.

Textile manufacturers do not pay a premium based solely on crimp, but it is considered an important trait in the manufacturing process (see Figure 6). People who say crimp is not important often say that textile manufacturers do not pay for it. This argument is deceiving because all sheep exhibit crimp. If some sheep's wool lacked crimp there would be a premium for the fleece that exhibited crimp. For many years, wool graders used crimp-per-inch to predict fineness and, therefore, price. With the advent of sophisticated electronic measuring devices, there is less and less reliance on crimp as an indication of fineness by manufacturers. But crimp assessment is still a useful selection tool for the alpaca breeder grading animals in his herd or for purchase, hence it has a breeding and a market value. For a thorough discussion of the importance of crimp, see Louis Chaves' comments later in the article.

Color: Alpaca fleece is marketed in many colors and color is an inherited trait that is easy to select. White is the color most desired by textile manufacturers because it can be uniformly dyed any color. Many mills will not purchase fiber if it contains more than ten dark fibers per 100 grams of fleece. Purchasers of breeding stock often pay premiums for certain colors and the rarest colors often bring the highest premiums.

Size: Size is highly heritable in all livestock breeds. Alpacas that are big and bold, exhibiting good vigor, fertility, and reproductive ability, are sought by knowledgeable purchasers of breeding stock. Small animals sometimes have reproduction problems and produce less fleece per animal.

Luster: Luster in the suri and huacaya is thought to be heritable. A bright, lustrous fleece is of considerable value particularly to purchasers of breeding stock. The hallmark of the suri is luster and it is important to the textile manufacturer because almost all suri fleece is used in outerwear. Coats made of suri glisten like mink and are often called "green" fur coats, as no animals are killed to produce them.

When considering alpacas as the sale product, genetic or breeding values (for traits such as density, crimp, color, size, and luster or brightness) would be considered by most buyers to have cash value.

MARKET VALUE CHARACTERISTICS

A characteristic with marketing value affects the price realized for the product by improving its presentation for sale. In the case of alpaca breeding stock, a certain type or color might have market value even though the fleece of the animal lacking type might sell at the same price. Market value characteristics enable cash value characteristics and breeding value characteristics to realize a higher price by improving the marketing environment.

Because the distinction between cash value characteristics, breeding value characteristics, and market value characteristics depends on the outlook of the buyer--whether they are buying for breeding or fiber--the value of some characteristics may change from one category to the other, or even cease to be credited with any value at all. Many of the breeding value traits described above, such as luster, also have market value (Figure 7). The manufacturer knows from experience that he can spin a longer and thinner yarn from wool with a low average fiber diameter so the wool buyer puts a cash value on fineness. Staple length is also of great importance in the manufacture of yarn and has a cash value. Type or density is of no value to the fleece buyer, but is very important to the buyer of breeding stock. Figure 7 allocates different characteristics into their value categories.

FIGURE 7: CASH, GENETIC, AND MARKET VALUE TRAITS

FLEECE CASH VALUE	BREEDING GENETIC VALUE	BREEDING MARKET VALUE
Fineness	Fineness	Pedigree
Staple length	Density	Breed Type
Color	Uniformity	Fineness
Cleanliness	Crimp (huacaya)	Density
	Lock (suri)	Uniformity
	Luster	Crimp (huacaya)
	Color	Lock (suri)
	Size	Color
		Luster
		Size
		Fleece Coverage

IMPROVEMENTS RECOMMENDED BY ALPACA TEXTILE MANUFACTURERS

At the International Camelid Festival in Arequipa in 1997, Louis Chaves, general manager of Inca Tops, S.A., a division of Grupo Inca, made several market-based suggestions for increasing the price of alpaca fleece to the primary producer or breeder. These recommendations could serve U.S. breeders well when they finally establish breed standards and objectively measured show rules.

First Chaves noted that many of the problems affecting the value of alpaca fiber could be traced to the animal production end of the chain value. These problems include: 1) the presence of kemp or guard hair in the fleece; 2) the lack of uniformity with the fleece, i.e., high standard deviation; 3) the purity of color, which includes problems such as black hair in white fleece, different tones of color over the entire fleece, and differing colors from animal to animal, and; 4) the lack of curl (crimp).

"These problems in the field are transferred to the textile manufacturing process in the following ways," said Chaves, "1) dyeing: Kemp or guard hair in the fleece makes it difficult to dye the fiber in pastel or brilliant colors; 2) weaving: The lack of uniformity or the presence of kemp or guard hair creates a prickle factor in the fabric or products, and; 3) knitting: The weight of a garment is critical, both in comfort and cost. Alpaca lacks sufficient curl or crimp, which is present in sheep wool, and adds volume to a yarn or garment without adding weight."

Chaves finished by saying "The industry needs to produce finer fiber, as fineness has a tremendous impact on price. We also need to find ways to correct the problems of kemp and hair color impurities. We need to address the problem of excess weight caused by lack of curl (crimp) so that lightweight garments, which are more comfortable for the consumer, can be manufactured, thereby extending the selling season into spring and summer."

HOW SHOULD THE ALPACA INDUSTRY PROCEED WITH REGARD TO SHOW RULES AND BREED STANDARDS?

All breed standards are not created equal. If breeders accept the premise that fleece is the primary end use of an alpaca, then it follows that the standards relating to an alpaca's fleece should be paramount. Breed standards should be weighted 60 percent for fleece and 40 percent for conformation. The weighting for individual fleece characteristics should be as follows:

HUACAYA	SURI
1. Fineness 30%	1. Luster 30%
2. Density 30%	2. Fineness 30%
3. Crimp 10%	3. Density 30%
4. Staple length 10%	4. Staple length 5%
5. Uniformity 10%	5. Uniformity 5%
6. Luster or brightness 10%	

In the future, say three or four more generations of alpacas, or 10-15 years, the weighting for the North American standards should probably be reset at 70 percent for fleece and 30 percent for conformation.

Conformation standards should be weighted as well, with an emphasis on traits impacting the ability to eat efficiently, walk, and reproduce easily. For instance, a good bite is critical if a female is to forage sufficiently for both her and her cria's needs. A well formed head tells the breeders that an alpaca does not have a high portion of llama blood. The legs must be correctly formed and positioned to allow the alpaca to graze pastures for sufficient time and distance to stay well nourished. A male must have large testicles to produce abundant sperm and strong back legs for use in mounting the female; back legs on a male

are more important than front legs on either a male or a female. Spring of ribs and a strong topline give a female good capacity to carry their young. Males, on the other hand, need the lung capacity to chase down females. Of the 40 percent allocated to conformation, the following order of priority is appropriate.

1. Bite and head
2. Testicles on male and vulva on female
3. Straight, strong legs, pasterns, etc.
4. Spring of rib
5. Strong topline
6. Correct proportion

The interrelationship of halter class shows, value characteristics, and breed standards are important concepts upon which the alpaca industry should agree. This does not mean that every breeder needs to agree to all the details of every standard. But by collectively defining the alpaca's major purpose, the important characteristics, appropriate conformation, and fleece standards, breeders will go a long way toward establishing the goals necessary to sustain positive improvement in the national herd.

HOW TO SELECT, BREED, AND SHOW - WINNERS

Before I give you my opinion on the subject of show winners, I want to make the following disclaimer. First, I no longer show alpacas; second, I serve on no industry boards or committees; and third I have judged alpacas in the United States, Canada, Australia, and Peru where I always judge by the prevailing rules. The following suggestions are based on my years of success in the show ring, my judging experience internationally, and my 17 years of experience selecting and breeding alpacas. These remarks, and the information in the above articles, are intended to be entirely apolitical.

There are some traits that are common denominators among prize winning alpacas. They include: 1) size - larger alpacas tend to win; 2) bite - a bad bite often eliminates an alpaca from competition; 3) in huacayas crimp wins; 4) in suris luster wins; 5) density often becomes a determining factor amongst similar alpacas; 6) fineness is good, but absolute superiority in fineness is rarely the determining factor in ribbon placement; 7) conformation rarely determines the winner because most alpacas that place have excellent conformation; 8) animals that lead well and do not pull against the halter do better than unruly alpacas that fight their handler making it difficult for the judge to see their true leg conformation; 9) presence is important as it catches the judge's eye, and; 10) grooming - animals that have not been brushed or beaten with a wand do better.

I will take the above factors one at a time and suggest how you might select for them or ensure the particular quality is in your alpacas. These suggestions are abbreviated. For a complete discussion of these ideas please read my book *Alpacas: Synthesis of a Miracle*.

1. Size is highly heritable and most studs who sire winners are large, say 35-38 inches at the wither and weighing 165-200 pounds.
2. Bite, never ever breed to a stud with a bad bite and do not bother to show alpacas with an obviously bad bite.
3. Crimp is highly heritable in my experience. Breed your females to older males that still exhibit crimp. Check a male's progeny to see if they generally exhibit crimp.
4. Luster, only breed to males with knockout, bright luster. Check a stud's progeny to see if they exhibit luster. And I mean "bright."
5. Density is easy to breed for. Simply measure the stud's fleece weight and check his progeny.
6. Fineness, check a stud's progeny for fineness. You must be careful here because fineness and density are often antagonistic traits. Winners are usually 20 microns or less, but remain dense. This number is higher in older animals.
7. Conformation, dose your cria with vitamins A, D, and E, particularly in the winter time or if you live in a climate with little sunlight. I have had few leg problems since I began this practice over 10 years ago.
8. Handling, do not wait until one week before the show to train your alpacas.
9. Presence, this is important, particularly with males. I recommend running your show prospects with females beginning at a young age, say 12 months and older. They can be pregnant females. It also helps to have them in a pasture next to a breeding male, the sights and sounds of their activity tend to jump start testosterone. The important thing is that they not run with older males that tend to intimidate and dominate younger males. The largest male in the pasture tends to have the best presence.
10. Grooming, less is better, but clipping away a little medulation and shaping the head a bit can't hurt.

As I said at the beginning, these are my opinions based on observation, success, and occasional failure. Let me know if they work for you. I do not expect this article to change many minds that are already made up, but with luck a few of you may give some consideration to the ideas presented. I intended this article to provoke and stimulate debate, which I think is healthy for any growing industry. I would love to hear responses, pro and con. Once we have an informed, objective debate we can collectively make better decisions.

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