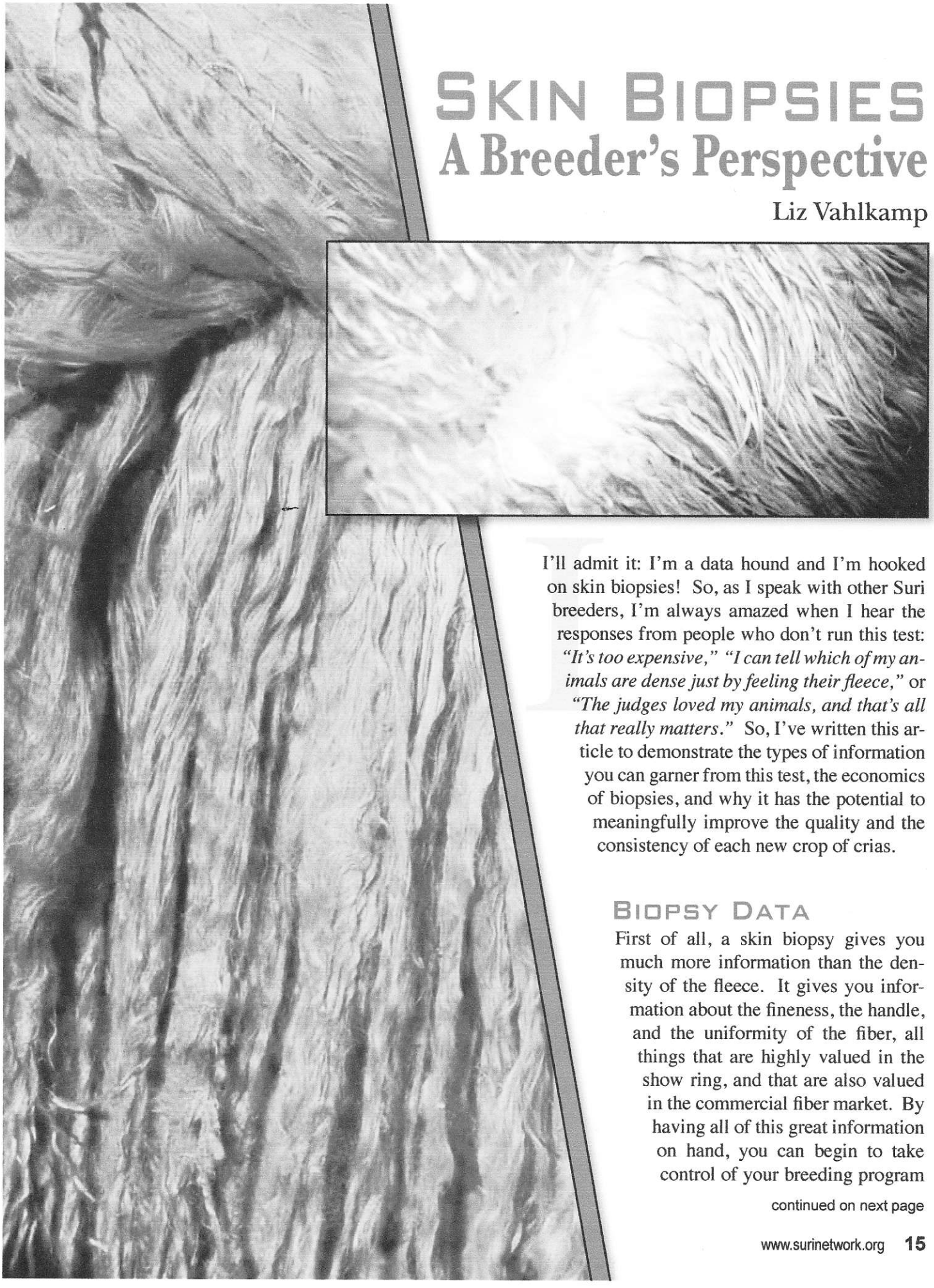
Skin Biopsies
A Breeder's Perspective

Liz Vahlkamp



I'll admit it: I'm a data hound and I'm hooked on skin biopsies! So, as I speak with other Suri breeders, I'm always amazed when I hear the responses from people who don't run this test: *"It's too expensive," "I can tell which of my animals are dense just by feeling their fleece,"* or *"The judges loved my animals, and that's all that really matters."* So, I've written this article to demonstrate the types of information you can garner from this test, the economics of biopsies, and why it has the potential to meaningfully improve the quality and the consistency of each new crop of crias.

Biopsy Data

First of all, a skin biopsy gives you much more information than the density of the fleece. It gives you information about the fineness, the handle, and the uniformity of the fiber, all things that are highly valued in the show ring, and that are also valued in the commercial fiber market. By having all of this great information on hand, you can begin to take control of your breeding program

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without a "hit and miss" approach.

The following information is provided regardless of which service you use for your biopsies.

Secondary to Primary Ratio (S/P)

This is a ratio you will see mentioned by breeders who run biopsies, and it is an important piece of information. Primary fibers, or "primaries," grow out of the skin as a protective coating against the elements. They are generally higher in micron, and they can influence the handle of the fiber. The secondary fibers in a cluster are those that grow around these primary fibers. They are generally softer and there are more of them. The higher the ratio of "secondaries" to primaries, the finer the overall fleece. Fineness is certainly important in the show ring, and it is also one of the key drivers in determining the value of a bale of fiber in the commercial market.

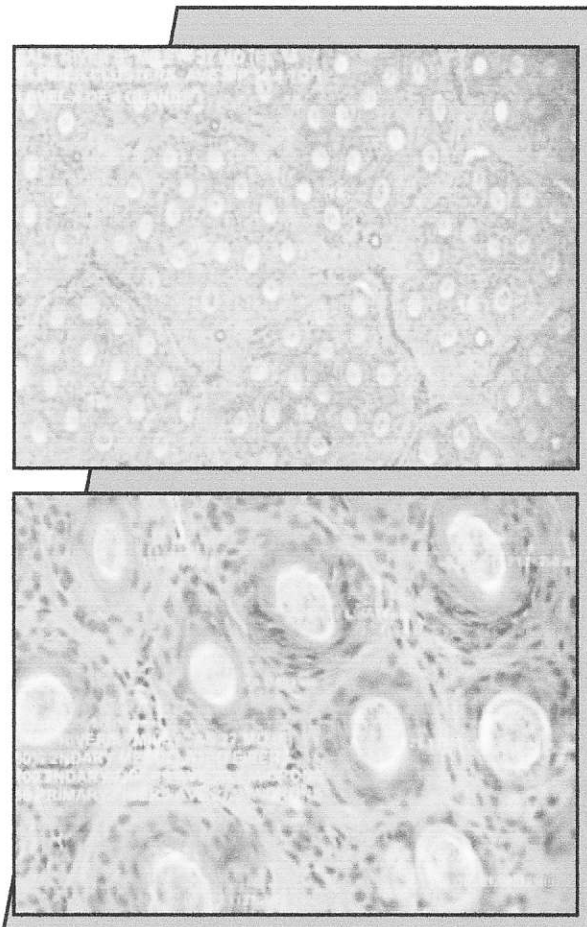
Micron Spread Between the Primary and Secondary Fibers

This is one of my personal favorites and it goes hand-in-hand with the S/P ratio. The ideal would be to have the primaries the same micron width as the secondaries, but a spread of five microns or less is thought to be exceptional. A significant difference in the spread between primaries and secondaries will lessen the handle of the fleece, and also impact processing and the quality of the end product.

The next time you run your hand down the neck of your Suri, it may feel soft and fine. But if your animal's primary fibers have a significantly higher micron count than the secondaries, you will feel something that just isn't quite right – almost like sand in the fiber that distracts from the fineness you are otherwise feeling. Judges will feel this in the show ring and it is possible that your animal will not place as well as one that has a more uniform set of fibers. It will make no difference that you have a fabulous mean fiber deiameter (MFD) on your histogram because of all the great secondaries your animal produces; if the micron spread is wide, the handle will suffer.

The reverse can be true as well. I have an older girl who runs 28 microns on her histogram, and she has a very low S/P ratio, but the spread between her secondaries and primaries is only five microns, which is considered highly desirable. The result is that her fiber feels relatively soft. The uniformity of her primaries and secondaries actually improves the handle on her fleece!

From the standpoint of the commercial fiber market, a significant difference between these types of fibers will have a negative outcome. Lack of uniformity in micron generally downgrades the value of a bale. This occurs for two reasons: Fiber spins differently depending on the micron level. If you have a group of secondaries at 20 microns, and a group of primaries at 30 microns, the machinery will process at some average of the two but the results will be less than adequate for either micron level. There will be



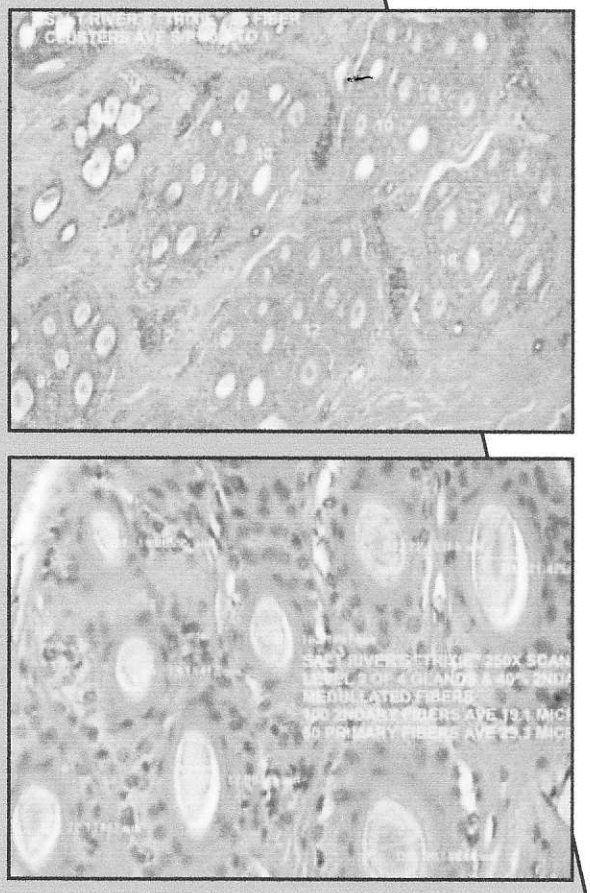
In this biopsy photo, this alpaca displays a high level of secondary to primary fibers, at 14.1.1, and also, a low micron range between her primary fibers (27.9 microns) and her secondary fibers (22.1 microns). In the lower photo, the primaries and secondaries appear to be of similar size. The result is an overall MFD of 23.1 and most importantly, a wonderfully soft hand, which was noted by fleece and halter judges alike.

Photos by Dr. Norm Evans

too much twist for the primaries and too little twist for the secondaries. Additionally, these higher micron fibers, will most likely poke out of the yarn and create a scratching sensation on your skin even if the secondaries are of a low micron. In either case, the result of large micron variances is poor handle and poor durability of the end garment. As a result, these bales will most likely be used for lower quality (i.e., lower margin) products.

Medullation

This measurement also affects handle and processing. A "medullated fiber" is one that has air pockets in some or all of the fiber. While these air pockets can help with warmth, they make the fiber stiff, and thus, they lessen the handle of the fleece. Guard hairs, which have a full hollow core, are the stiffest and are considered a subset of overall medullated fibers. When medullated fibers are processed, they tend to poke out from the yarn and lessen the handle of the garment similarly to the high micron fibers mentioned in the prvious section. Note that most alpacas have some level of medullation, so breeding it out is not epected. But limiting the percentage is a worthy goal.



Here we contrast the resultes with the photos on the previous page. This alpaca has a respectable ratio of secondaries to primaries at 10.4:1, and her secondary fibers average 19.1 microns at five years of age - not bad. But look at the primary micron average - at 29.3 microns, that is a very different fiber to spin than the 19.1 micron fibers! And while her histogram consistently comes in at around 21 microns MFD, her handle does not feel as good as one would expect for a 21-micron fleece. The lower photo shows a marked range in size of each follicle.

Photos by Dr. Norm Evans

Density

This is, of course, the measurement that everyone associates with skin biopsies and it is the measurement that most often surprises breeders receiving their results. Why? Well, because there are so many variables that can throw off the hand when trying to determine density by simply feeling the fiber:

- **Micron levels between animals –** If you have one animal with fiber at 20 microns, and another at 25 microns, the 25-micron animal may feel more dense because the fibers are wider. So, unless you are comparing two animals with the same mean fiber diameter (MFD) and standard deviation (SD), you are not going to be able to do a fair comparison.
- **Medullation –** As mentioned above, medullated fibers are stiffer. If you are comparing one animal with a great degree of medullation with one that has little, the higher medullated animal might "win" the density contest, though again, the reality may be much different.
- **Weight –** A fleece with higher micron and/or longer staple length is going to weigh more than a similarly dense fleece with lower micron and/or staple length. If you try to use weight alone to determine density, you are likely to get it wrong.
- **Wide spread between secondaries and primaries –** Again, the higher micron fibers in the fleece are going to give the hand the illusion of greater density.

Additionally, when feeling by hand, the best you could hope to do would be to determine which of your own animals is the densest. However, with a

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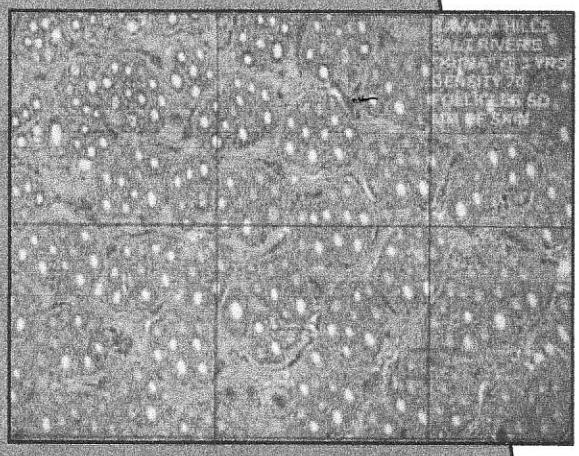
skin biopsy, you will know where your animal stacks up relative to a much larger pool.

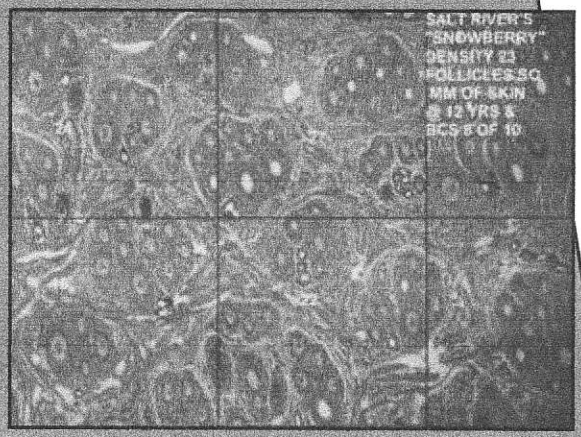
The importance of density cannot be overstated because it impacts so many other factors in the fleece. Of course, the greater the density, the greater the dollars back per animal fleece. However, research also suggests that with increased density comes greater fineness and greater organization of lock, which mean little to no cotting.

The significance of density as it relates to lock organization is again relevant in the show ring and the fiber market. For the show ring, good organization of the locks in a uniform manner across the animal means good phenotype. We all know that this is one of the key fiber components that judges look for. Note: It does not mean twisted locks all the way to the skin – it means good lock definition all the way to the skin.

On a more practical level, poor organization of locks creates cotting, which creates a significant devaluation of the fiber in the commercial market. Cotting occurs when fibers grow at odd angles from the skin, thereby crossing over one another and becoming entangled. Once the fibers do cross over and tangle, they will break, creating "shorts" in the fiber; this leads to shedding in the yarn, significant fiber loss while processing, and overall poor durability of the yarn. Contrary to popular belief, cotting does not occur because an animal is dense, nor does it occur because an animal is fine.



This alpaca demonstrates a high degree of density at 70 follicles per sq. mm. and the reader can see from the photo that the clusters are organized and clearly defined. This organization is typical of a densely fibered animal.



This alpaca's density results are more typical of the average Suri - at 23 follicles per sq mm, she is light on density. The clusters are not as organized and the follicles are understandably more spread out.
Photos by Dr. Norm Evans

Possible Road Blocks

Let's look at a few roadblocks that people throw up when deciding not to do biopsies:

1. *"I don't know which service to go to. I've heard the density results are different, and only one can be right. Since I'm not qualified to figure out which one is accurate, I'm just going to skip doing biopsies."* I'm going to give you a breeder's response: I don't know either and I don't even know if it is true that the results are different. But I do know that each service has a large pool of data and each has a consistent method for measuring density from one biopsy to the next. So if I select a service and stick with it, I can compare animals within my own herd accurately, and I can compare my results with the larger pool to see how my breeding program stacks up. Select who you are comfortable with, and don't let this roadblock stand in your way.

2. *"Biopsies are too expensive."* I look at this roadblock in three ways:

   a. **A one-time cost –** This is a one-time expense, and as demonstrated above, I actually get at least four pieces of data when doing a biopsy. The typical cost of a biopsy is $200-$250, so that is only $50-$62.50 per data point.

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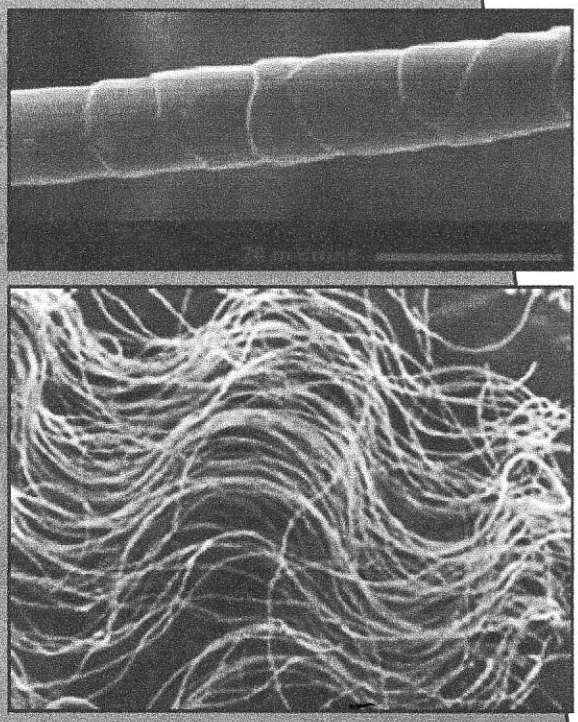
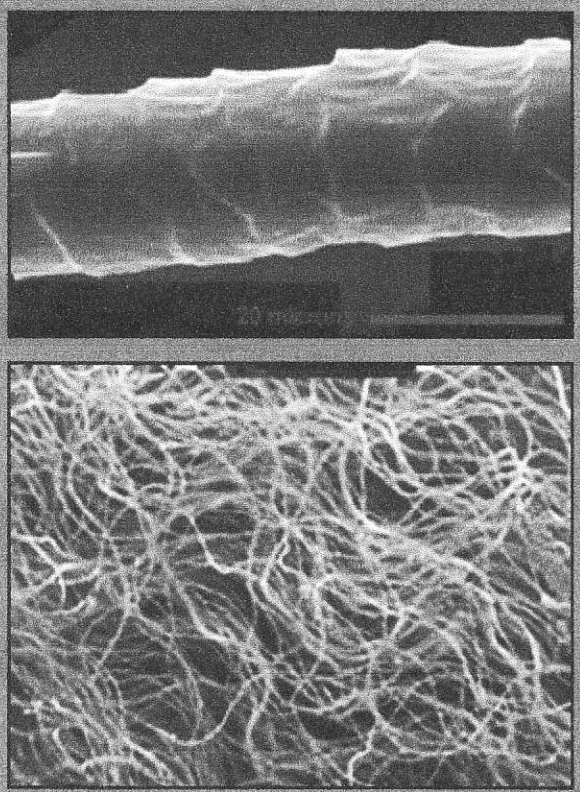


These fibers are all smooth, as shown by the single fiber photo, and are all growing from the skin in an organized manner which discourages the fibers from crossing over each other and cotting.
Photos provided by Ian Watt, Alpaca Consulting USA



In contrast, these fibers are rough, prone to catching on each other, and as seen in the second photo, are growing at different angles, creating a cotted, poor quality fleece.
Photos provided by Ian Watt, Alpaca Consulting USA

b. **Showing vs. biopsies –** I love showing, and one of my third-party data points is often from the show ring. However, think about the cost. Approximately $130 per stall, a $35 entry fee, gas to and from the show of approximately $120, the hotel for two nights at $200, and food of around $30. I've just dropped $515 for a judge to tell me where I rank among a small group of farms standing in the ring with me...and judging is highly subjective! For the same amount of money, I could have gotten two biopsies done and received concrete, objective information on my animals and compared those results with hundreds of other animals in the data pool.

c. **Outside breedings –** I try to purchase one or two outside breedings each year to keep some genetic diversity running through my herd. But gone are the days when I will purchase a breeding without knowing the biopsy results of the herdsire. Why? Well, breeding fees are $1500 or more. So, I want to make sure that I am getting the most for that money. At $1500, I could test two of my herdsires and four of my girls and make a more knowledgeable breeding decision than breeding a girl to a male about whose fiber I know little or nothing!

3. *"I run histograms, and that tells me all I need to know."* Histograms are great. I run them on my whole herd — show quality and fiber quality animals alike — remember, I'm a data hound! They are a great first step to confirm what I'm feeling in the fleece. They even give some similar information to what you see above. But they don't tell a detailed story. I may know that my coefficient of variation (CV) is high, but I don't necessarily know how to correct it. Do I need to increase my S/P ratio? Do I need to narrow the micron spread between my primaries and secondaries? Do I need to improve the density of this animal to try to secure an overall better fleece? Additionally, histograms will reflect not only genetic information, but also environmental conditions such as stress and nutrition. Running the skin biopsy fills in the genetic question marks and gives me better information as I make the next round of breeding decisions.

What Biopsies Are Not

Now that I've talked you into doing that first biopsy, I'll toss out three cautionary points. First, biopsy results are not a promise that the offspring from the sire and dam will inherit all the positive traits of each. By themselves, biopsy results simply give each breeder a better, more objective roadmap to matching males and females. Heritability is determined by Expected Progeny Differences (EPDs) and while some day information from a skin biopsy may be part of the EPD measurements, for now, it is not. Therefore, it is incumbent upon each farm to secure biopsies from each of their offspring to determine their own results for heritability.

Second, alpacas are known for their lack of uniformity across the blanket and a skin biopsy is only taken from one small spot on one side of the animal. As such, each breeder must use common sense when interpreting the results. Biopsies do not necessarily represent every inch of your animal's fleece. I had an animal that had wonderful density results and great lock definition where the biopsy was taken. However, I also knew that he cotted each year all around his shoulder area, so I knew to factor in my own knowledge of the animal with the results from the density test.

Third, biopsies are most useful if they are taken at or after 18-24 months of age. Before that tine, the derived secondaries are still maturing and increasing in size. Also an alpaca will have greater density when it is young and still growing than it will have at maturity. Thus, biopsies at less than 18-24 months are not a fair representation of the alpaca's true fiber make-up.

Conclusion

While skin biopsies are not the "end all, be all" of better breeding practices, they do provide a wealth of information that can be used to improve one's breeding program. As our industry moves forward and fiber becomes an even more important part of the picture, making smart breeding decisions to improve our national fiber clip will become increasingly important. Biopsies are a great tool to help make those smart decisions. ●

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Liz has raised alpacas for seven years and is the past chairperson for the Suri Network Product Development Committee (SNPDC). Liz has published numerous articles in PurelySuri on behalf of the SNPDC, and is now starting up the North American Suri Company, a company dedicated to purchasing, processing and marketing North American Suri fiber to the fiber arts and textile communities.