HOW DO YOUR PRIMARIES COMPARE WITH YOUR SECONDARIES?

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Alpacas have a two coated fleece made up of primary and secondary fibres. These fibres are arranged in clusters, each of which contains one primary fibre and about ten secondary fibres. This ratio is referred to as the SP ratio and has been found to vary from about 6 to 13 and occasionally up to 16. For merino sheep, the ratio averages about 20 but can be twice this. As an alpaca ages, the diameters of the primary fibres increase at a faster rate than the secondaries and may eventually become fully medullated. These fibres are then referred to as the guard hairs of a fleece.

There is also a strong positive correlation between the density of fibres in a fleece and the number of clusters per square millimetre of skin[1]. The number of clusters or rather the extent of the space between the clusters has a far greater impact on the density than the number of fibres in each cluster (SP ratio+1). This means that the denser the fleece the more primaries there are, however the average percentage of primaries to secondaries remains similar at about 10% for any one alpaca.

There is therefore a definite advantage in reducing the diameter of these primary fibres if one is breeding for density and reduced guard hair.

THE COMBINED HISTOGRAM

Separate histograms can be produced for the secondary and primary fibres in a fleece sample and the overall fleece sample histogram is essentially the summation of these two (Figure 1). Although the secondary fibre histogram is reasonably symmetrical, this is not the case for the fleece histogram. This is because the majority of primary fibres are coarser than the majority of secondary fibres and when the two histograms are summated to form the combined fleece histogram it will skew towards the coarse edge. The extent of the difference between the averages of these two fibre types determines the amount of skew in the combined histogram. The shape of the fleece histogram therefore gives a strong indication of how fine the primaries are relative to the secondaries.

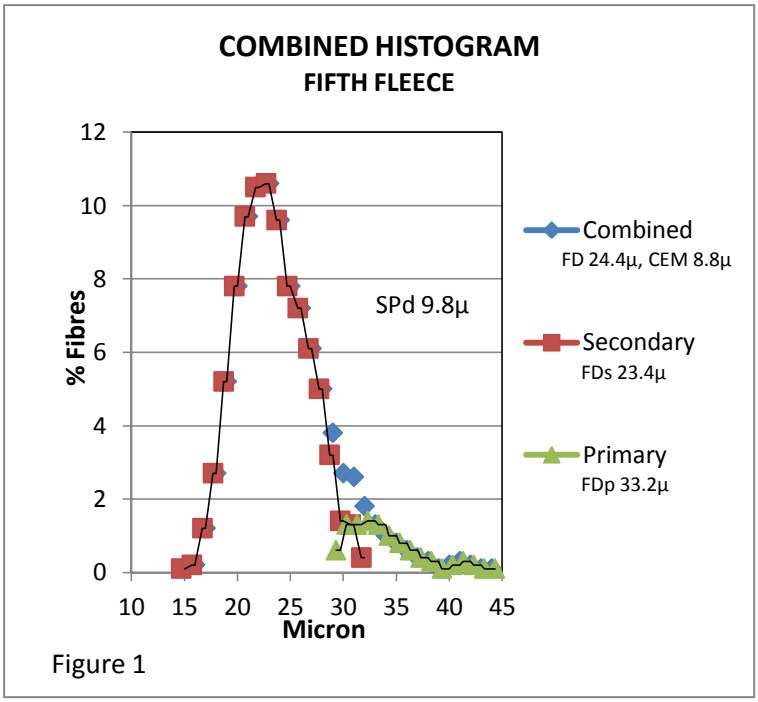


Figure 1

If the average primary fibre diameter (FDp) is less than the average secondary fibre diameter (FDs) then the combined fleece histogram will skew towards the fine edge rather than the coarse edge however if the two averages are about the same, the fleece histogram will be relatively symmetrical but will still have some skew towards the coarse edge. In extreme cases where there is a large difference between the two averages, the fleece histogram will be bi-modal and the two peaks will define the two averages.

ESTIMATING THE FDp AND FDs

It is possible to estimate the average secondary and primary fibre diameters from most fleece histograms that skew towards the coarse edge (Figure 1). To do this it is necessary to assume that all the fibres in the coarse edge tail are primaries and that the SP ratio is 9 (i.e. 10% are primaries). These are reasonable assumptions for the majority of alpacas and for the few exceptions the outcome will not be greatly affected. The average fibre diameter of a sample (FD) obtained from the fleece test results can then also be calculated from the formula, FD=(9FDs+FDp)/10.

When the SP ratio is greater than this assumed value of 9, the average fibre diameter is unlikely to vary by more than about 1.5%. This error is less than the combined sampling and testing errors associated with the FD obtained from the test results[2].

If the FD and coarse edge micron (CEM) are known from the test results then an estimate of the FDp can be calculated. This is because the coarse edge micron (CEM) of a fleece histogram is the number of microns separating the average fibre diameter of the sample from the coarsest 5% of fibres in the sample. If these coarse fibres contain only primary fibres and 10% of all the fibres in the sample are primaries then the CEM will define the average fibre diameter of the primaries. It will be the average fibre diameter of the sample plus the coarse edge micron, (FDp=FD+CEM).

This formula indicates that the average primary fibre diameter can be decreased by reducing the FD or the CEM or, better still, both. It also indicates that the CEM is a reasonable indication of the extent of skew in a histogram.

Once the FD and FDp are known, the average diameter of the secondaries can also be calculated by rearranging the above formula for FD, so that FDs=(10FD–FDp)/9.

THE SECONDARY TO PRIMARY DIFFERENCE

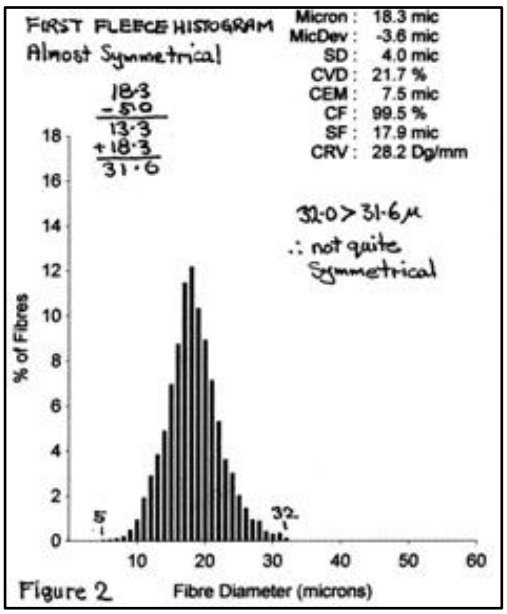
Having calculated the approximate FDs and FDp, the difference between the two can then be estimated. These calculations need to be carried out at least twice, on say the second and fifth fleece, to determine to what extent the primaries are blowing out relative to the secondaries. An alpaca's fleece will have only limited commercial value if the secondary to primary difference (SPd) blows out excessively after its second fleece.

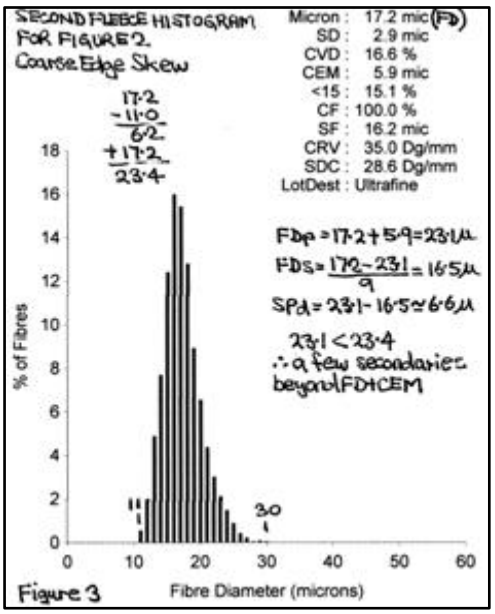
Ideally, the primaries should have a similar diameter to the secondaries and remain that way as the alpaca ages. This would then produce a fleece histogram that remained relatively symmetrical. But how realistic is this ideal?

A histogram is assumed to be symmetrical when the range of fibre diameters finer than the FD equals the range coarser than the FD or in other words when its base length each side of the FD is the same (Figure 2).

First fleece histograms are sometimes relatively symmetrical but this is not because the primaries are similar in diameter to the secondaries. It is because the very fine secondary derived fibres that are the last to develop after birth produce a fine edge tail with enough fine fibres to compensate for the primary fibres in the coarse tail. This compensating effect disappears in the second fleece, since all the secondary fibres are then of a similar age (Figure 3). If the primaries were of a similar diameter to the original secondaries then these first fleece histograms would skew towards the fine edge.

When a first fleece histogram is relatively symmetrical, it is probable that these alpacas are close to achieving their genetic potential for follicle development. It is however unlikely that the primaries will ever be as fine as the secondaries and therefore second fleece histograms will always skew towards the coarse edge and subsequent histograms will increasingly skew as the primaries blow out (Figure 1).





LIMITATIONS OF THESE ESTIMATES

As the fleece histogram for different alpacas becomes more symmetrical it will start to include secondaries along with the primaries in the coarse edge beyond the CEM and the CEM will increasingly over estimate the average primary fibre diameter. When this occurs the actual FDp will then be less than FD+CEM.

Based on the assumption that the secondary histogram is relatively symmetrical, anecdotal evidence suggests that this will often start as the CEM falls below about 8 microns. For some alpacas however it appears not to occur until about 6 microns or even lower (Figure 3). These are the alpacas that usually have a fine fleece with a low standard deviation. The coarse edge tail will be shorter and its fibres will be finer.

The average primary and secondary fibre diameters obtained from the above formulas will not necessarily be similar to values obtained from skin test results. This is partly because the annually tested fleece sample is rarely collected at the same time of the year as the skin sample and will not have been taken from the same location. More importantly however, the fleece sample results are obtained from thousands of individual measurements taken between and along the fibres, whereas the skin test results are obtained from around 100 secondary fibre measurements and maybe 50 primary measurements. It is therefore inevitable that, with such a large difference in sample size, the results are not going to be the same.

REFERENCES

1. Kingwell, R., 2010. Can Guard Hair Be Bred Out Of Alpaca Fleece? Alpacas Australia Issue 60: Winter 2010.
2. Victorian Department of Primary Industries, 2006. Variation in and Sampling of Alpaca Fleeces, Note Number AG0022: Updated January 2007.