ARE SMALL FLEECE STAPLES INDICATIVE OF A DENSE FLEECE?

(Bob Kingwell, Monga Alpacas, April 2021)

There is a belief in the alpaca industry that fleece with small/thin/fine well-defined staples/pencils/bundles will be dense. Anecdotal evidence however suggests that this is not necessarily the case since some fleeces with small staples are not heavy fleeces.

So, what does a heavy fleece have to do with density? Well, density is the number of fibres within a specific skin area and is usually expressed as the number of hair follicles per square millimetre of skin. Fleece weight on the other hand depends on the total number of fibres within a fleece. Although weight cannot be used as a specific measure of density, it can be used to compare the densities between different fleeces if a number of assumptions are made.

To answer this question, I looked at 216 test results from alpacas over the last three years that were no more than 5 years old and made the following assumptions.

- The weight of a fleece is determined primarily by its density, micron, length and extent of skirting. Other factors such as the standard deviation of fibre diameters and shearing quality have not been considered.
- There is a strong correlation between density and fleece weight. A comparison of densities can therefore be made using skirted fleece weights adjusted for the effects of micron and length.
- Adjusted weight used is the actual weight adjusted to a standard fibre volume based on an average diameter of 20 microns and an adopted length of 100mm using the following formula: Adjusted Weigh = Weight x (100/SL) x (20^2/FD^2). This micron was adopted since it was approximately the average for all the fleeces.
- Effects of skirting have been considered to the extent that all fleeces have been skirted to the same standard by the same person and assessed within each age group to reduce the effects of increased skirting requirements as alpacas age.
- The staple size has been assessed visually and determined as having either small well-defined staples (Small), medium size moderately defined staples (Medium) or large poorly defined staples (Large).
- It has been assumed that alpaca size variations occur throughout each age group for both the upper and lower weight ranges. No allowance has therefore been made for the effects that size has on fleece density.

A comparison between fleeces showed that heavy fleeces often had small well-defined staples. This stapling in most cases however also occurred throughout the range of weights for each age group.

The results below show the number of fleeces for each alpaca age and the percentage that were assessed as having small well-defined staples.

DEGREE OF STAPLING FOR ADJUSTED FLEECE WEIGHTS AND ALPACA AGES

		UPPER 50% OF ADJ.WEIGHTS			LOWER 50% OF ADJ.WEIGHTS		
AGE	NUMBER	SMALL	MED.	LARGE	SMALL	MED.	LARGE
1st FLEECE	76	22 (29%)	15	1	17 (22%)	13	8
2nd FLEECE	50	7 (14%)	10	8	6 (12%)	6	13
3rd FLEECE	46	5 (11%)	9	9	2 (4%)	5	16
4th FLEECE	26	3 (12%)	4	5	2 (8%)	2	10
5th FLEECE	18	1 (6%)	5	3	0	2	7

The number of fleeces for each age group came from both males and females. The reductions in these numbers with increasing age are the result of alpaca sales and losses resulting from bush fires at the end of 2019 and wild dog attacks after the fires.

DISCUSSION

If fleece density is determined by the number of fibres within a given skin area, then an alpaca's 1st fleece will always be denser than its subsequent fleeces since the number of fibres remains the same as the skin area increases to its adult size. The average density of small alpacas will always be greater than the average density of large alpacas and a very dense small alpaca will always be denser than a very dense large alpaca. Comparisons of density between different sized alpacas will therefore not be reliable. The results above attempted to reduce this problem by only comparing fleeces within the same age group. Once an alpaca is fully grown however its density should remain relatively stable. Comparisons however between the 3rd, 4th and 5th age groups would not be reliable due to the increased skirting requirements as alpacas age.

Almost a third (29%) of 1st fleeces within the upper half of the adjusted weights had small well-defined staples. This fell to 22% in the lower half of the weights. The high values for 1st fleeces are probably due to the small size of these alpacas. By the time the fleece has been tested the skin follicles will have produced all their fibres and the skin area of each staple will be as small and dense as it is ever going to be. As an alpaca grows and the skin area increases, the staple size will increase and its density will decline. The staple will also not feel as dense even though the same number of fibres are being felt. The larger staple will feel easier to depress and roll through the fingers due to the fibres being further apart.

For the 2nd year fleeces there were almost as many fleeces with small staples in the upper half of the adjusted weights as in the lower half; 14% and 12% respectively. These fleeces are generally the most reliable indicator of density when using fleece weights since all fibres have grown over the same period of time and skirting requirements are minimal compared to future years. In a first fleece, primary fibres are generally the longest and thickest and secondary derived fibres the shortest and thinnest. These size variations tend to distort the weight but do not affect the density.

Only one fleece, representing 6%, of the 5th fleeces had small staples in the upper half of the weights and none in the lower half. This decline is even more than the figures suggest since by the time alpacas reached their fifth year, most of the males had been removed from the herd and those that remained were either stud males or considered to have better quality fleeces with the potential to be stud males.

As an alpaca ages, relatively small staples will increasingly be indicative of a dense fleece. It is suggested that such an alpaca will not only have dense staples but also a high staple density within the fleece resulting in it maintaining relatively small staples as it ages. More staples mean less bare skin between the staples as the skin stretches with increasing size. Its density however will never be as high as it was when it was smaller.

The fleece pictured shows small well-defined staples in a 3rd year fleece. It also had the heaviest adjusted weight in that age group (FD 15.5µ, SL 95mm, Weight 1.6kg, Adjusted Weight 2.8kg). However, another fleece in the same age group with small well-defined staples was in the lower quarter of the weights and had the following results: FD 24.1µ, SL 95mm, Weight 1.57kg, Adjusted

Weight 1.14kg. The range of adjusted weights in this age group varied from 0.69kg up to 2.8kg with the average being 1.42kg.

It is worth noting that both these fleeces had similar skirted weights and lengths however, when adjusted for micron, the adjusted weights were very different. This demonstrates the difficulty in comparing fleeces for density when microns are not similar. Based on the adjusted weights, the 15.5µ fleece is certainly the densest of the two.

CONCLUSIONS

Dense fleeces tend to have small well-defined staples but small staples do not necessarily indicate that the fleece is dense. This is particularly the case for 1st year fleeces.

Density will depend on the number of fibres within a staple, on the number of staples within a fleece, and on the age/size of the alpaca. These 1st year fleeces generally have a high percentage with small staples but not necessarily with a high staple density and/or a high density of staples within the fleece.

Assessment of density by finger feeling a staple or compressing the fleece against the skin or within a fist will not be reliable when comparing fleeces. This is because density depends only on the number of fibres within a staple, on the number of staples and on the size of the alpaca. The perception of density is influenced by the micron of the fleece and its standard deviation and by its character. Thicker fibres with a large variation in diameters will usually feel denser than a fine fleece with its primaries under control. The extent of crimp definition and frequency will also affect the feel of density since staples with a deep amplitude and high frequency usually feel denser than those with low amplitude and frequency.

Micron generally has a greater effect on the adjusted fleece weight and therefore its density than staple length. This is to be expected since microns are raised to the power of 2 in the weight adjustment formula. Adjusted weights were generally heavier than measured weights for fleeces with microns less than the adopted standard of 20µ and lighter for fleeces with microns greater than the standard. Exceptions however did occur when microns were close to the adopted standard or staple lengths differed by at least 10mm from the 100mm adopted standard. The outcome from the results would still be the same regardless of the values used to define a standard fibre volume.