Using ‘Fibre Growth Profiles’ to monitor fibre follicle development in alpacas.

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Introduction

While many alpaca breeders have incorporated objective fibre measurement into their herd management strategies, ‘Fibre Growth Profiles’ are becoming popular for monitoring pre and post natal nutrition, particularly during the critical period of secondary follicle development in unborn crias.

‘Fibre Growth Profiles’ are linear graphs depicting variation in diameter along the fibres. This allows alpaca breeders to track nutritional intake of both the pregnant female and the cria in order to manage the development of secondary follicles, and thereby maximise potential for fibre density, fleece weight and fibre diameter.

Follicle development in Alpacas

As many alpaca breeders would be aware, it is the primary follicles that produce fibres that tend to be the broadest and most problematic fibres found within fleeces. It would come as no surprise that we refer to these as primary fibres. Conversely, the secondary follicles produce the finer and more luxurious secondary fibres within fleeces.

While much of the research into skin follicle development revolves around the merino industry, some recent work has been completed that specifically relates to follicle development in alpacas. In the research paper titled ‘Relationships between skin follicle characteristics and fibre properties of Suri and Huacaya alpacas and Peppin Merino Sheep (Ferguson et al, 2012), it was shown that skin follicle characteristics in alpacas are similar to that of merino sheep. One noted difference, however, was that while follicle groups in merinos contained around 3 primary follicles surrounded by a cluster of secondary follicles, follicle groups in alpacas contained only one primary follicle, surrounded by (around 3 to 10) secondary follicles.

More importantly, the Ferguson et al study revealed a significant negative correlation between secondary follicle density and mean fibre diameter. In other words, the greater the number of secondary follicles, the lesser the mean fibre diameter. Presumably, this correlation is the result of the increase in the ratio of finer secondary fibres against the broader primary fibres. It is also reasonable to suggest that the greater number of secondary follicles, the higher the fleece weight.

To many breeders, this is the Holy Grail – more fleece of lower diameter. The question then becomes, how to increase the number of secondary follicles.

Interestingly, the research found suri’s had a significantly higher follicle density than huacaya’s.

It is clear through previous research as revealed in Dr Julio Sumar’s paper ‘What makes a champion’ (Alpaca Western Extravaganza, 2004), increase in available nutrition to the unborn cria foetus maximises the chances of the foetus to achieve its genetic potential with regard to the number of follicles developed. Secondary follicles develop predominately from day 187 to day 217 during pregnancy, although further development and maintenance of secondary follicles can be an issue through to birth and up to 6 months after birth, although once a cria reaches about 70 days of age, secondary development has largely ceased, and will remain for the balance of its life.

I should stress at this stage that research concerning the timetable for follicle development in alpacas is lacking at the moment, however, Dr Sumar's comments on this point are worth taking on board.

From the Ferguson research and above comments of Dr Sumar, it can be taken that an increase in nutrition to the pregnant female during the latter half of pregnancy followed through to at least the second month after birth, will lead to an increase in the number of secondary follicles in the cria. Consequently, this should result in an increase in the overall fibre density or fleece weight, increase in secondary/primary fibre ratio and decrease in average fibre diameter for the lifetime of the cria.

To validate this finding, I refer to the 'Lifetime Ewe' project in the Australian merino industry whereby an identical feeding regime, albeit synchronised to merino skin follicle development, has recorded significant increase in fleece weights combined with decrease in average fibre diameter as well as increase in body weight for the life of the sheep (relative to similar sheep that had not been subject to the feeding regime).

The one thing I should stress at this stage is that this improvement in fleece traits is confined to 'environmentally' influenced improvements rather than improving genetic potential. It will, however, enable the alpaca to maximise its genetic potential with regard to fleece traits.

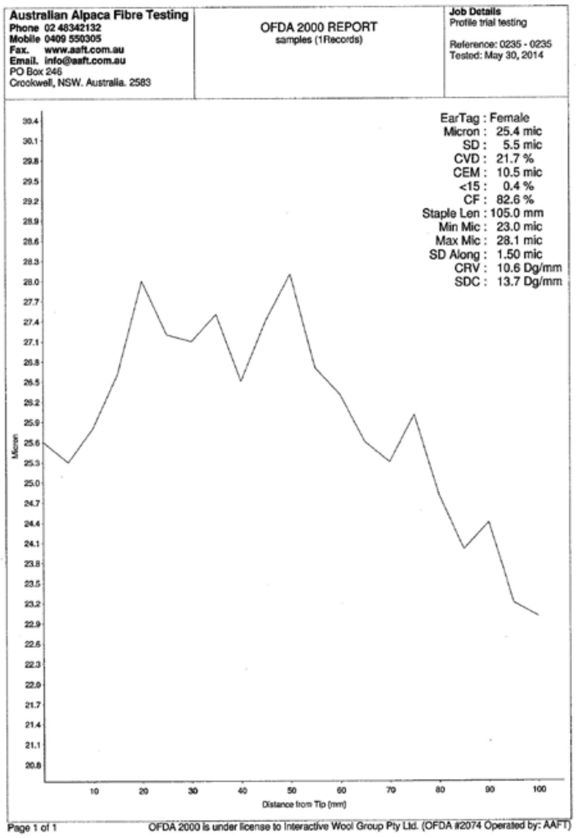
Tracking nutrition using 'Fibre Growth Profiles'.
When using OFDA2000 fibre measurement technology, a linear graph is provided that reveals the variation in fibre diameter along the sampled fibres. The horizontal axis of the graph depicts length along the sample in millimetres, while the vertical axis depicts fibre diameter. As the left side of the graph indicates the commencement of the growth period while the right side is the point where the fibre was cut from the alpaca, we read the graph from left to right.

By using the fibre growth profile, we are able to observe the variation in the amount of nutrition reaching the fibre follicles. If we observe the profile dropping, then this reflects a drop in nutrition such as experienced from internal parasite burden, disease and inferior feed conditions. If the profile is rising, then this reflects a rise in nutrition such as effective drenching or improvement in quantity and/or quality of feed.

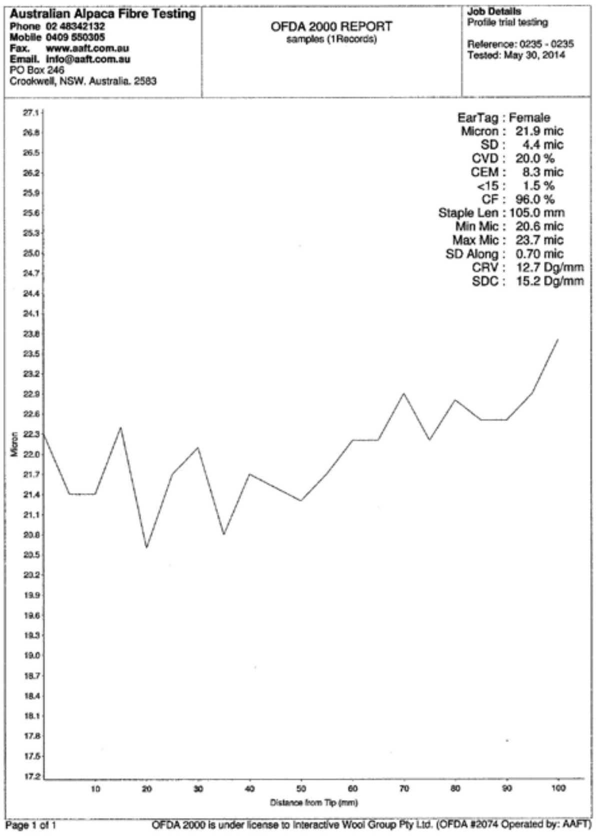
To illustrate the effect of using Fibre Growth Profiles for monitoring the availability of nutrition during the period of secondary follicle development, two sets of profiles are shown below.

The first set (figure 1) were derived from samples tested of two suri females, with samples taken approximately two months after their respective crias were born. The second set (figure 2) are profiles derived from testing samples from two suri crias, taken approximately six months of age. In both cases, the date of testing could not be verified, and was based on information from the breeder. Cria A is the progeny of female A, while cria B is the progeny of female B.

<u>Figure 1: Examples of Fibre Growth Profiles for two females bearing offspring</u>



Female A



Female B

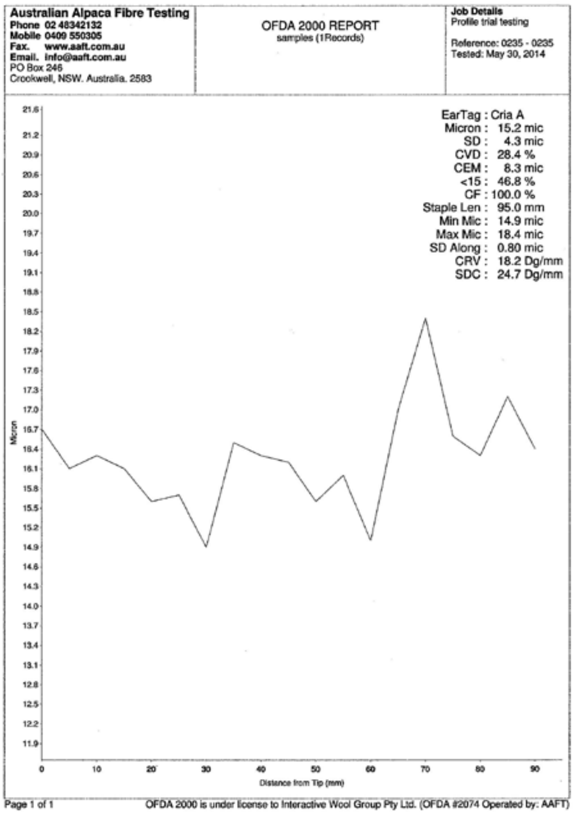
In the case of female A, the Fibre Growth Profile shows a slight increase in nutrition at the commencement of the growing season (after shearing), then a significant decrease in nutrition which was a result of a deterioration in paddock feed quality. Insufficient supplementary feed was provided to offset the increased demands on the mother's nutritional requirements arising from the developing foetus. The decrease in nutrition occurred at the crucial period of half way through pregnancy and continued after birth up until the time of sampling.

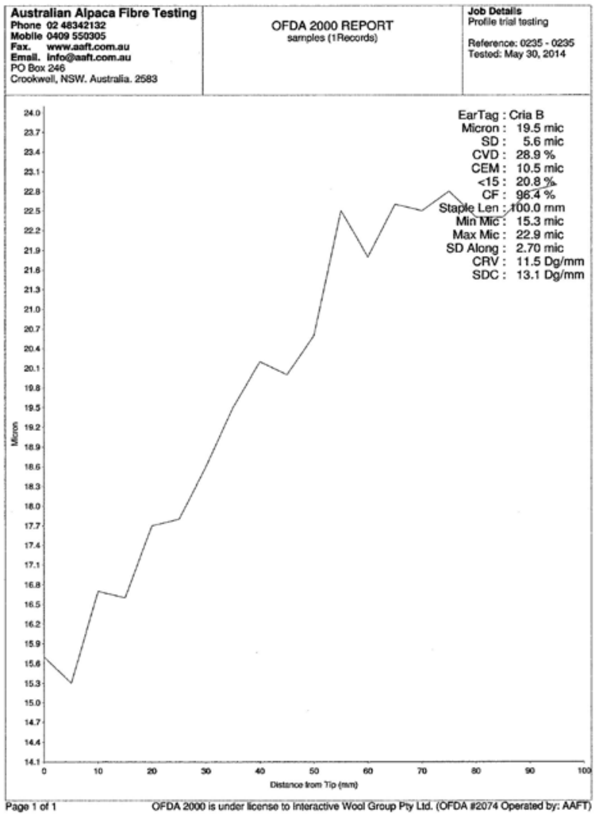
From this, it can be assumed, the development of secondary fibres in the unborn foetus would have been significantly affected, resulting in less secondary follicles leading to lower fibre density, lower secondary to primary fibre ratio with consequent higher average fibre diameter relative to genetic potential.

In the case of female B, the Fibre Growth Profile shows a gradual increase occurred over the entire growing period. The female was fed a high energy/protein supplement at an increasing level to offset the increased demands from the developing foetus and period of lactation. As can be seen from the profile, the increased rate of supplementary feed was slightly more than what was required, however, this is desirable as too much weight gain during pregnancy may lead to birthing problems.

From this, it can be assumed the development of the secondary follicles benefited from the increased nutrition, and as a consequence, allowed a higher fibre density, higher secondary to primary fibre ratio, and low average fibre diameter relative to genetic potential.

<u>Figure 2: Examples of Fibre Growth Profiles for two crias</u>





Cria A ***Cria B***

As previously mentioned, cria A was the progeny of female A. In the case of this cria's Fibre Growth Profile, the left edge of the graph depicts commencement of fibre growth in the unborn foetus. In the case of cria A, there is no evidence of an increase in nutrition reaching the foetus from the female. The slight spike in the profile near the end of the season was probably due to a spring burst after birth, although the precise point of birth on the profile is not known.

The assumptions made from observing female A's profile, appear to be validated in cria A's profile in that secondary follicle development is likely to have been negatively affected through poor nutrition.

On the other hand, cria B's Fibre Growth Profile shows a typical rise in nutrition as a result of enriched nourishment from a female receiving adequate nutrition. It should be noted that a rise of over 10 microns during the first year of fibre growth is not uncommon. Clearly, this cria is likely to benefit from high numbers of secondary follicles leading to high fibre density, high secondary to primary fibre ratio and lower average fibre diameter relative to genetic potential.

It is worth noting that some breeders who use profile tracking have observed acceptable profiles of females through the pre and post natal period, yet the profile of the cria during this period has not shown the typical increase in nutrition. In this case, it appears the female has difficulties with passing nutrition to the cria, which is obviously an issue worth addressing.

What are the benefits?

It needs to be remembered that tracking Fibre Growth Profiles provides an historical account. If a problem is identified such as a sharp drop in nutrition, then largely, the damage is done. The benefit of monitoring profiles, particularly concerning evidence of nutrition that might affect follicle development is that it allows critical issues to be resolved for future impact such as adjusting levels of suitable feed. In the examples above, the owner of female/cria A had been made aware that pre and post natal nutrition was significantly lacking, and that their alpacas were being denied the ability to achieve anywhere near their genetic potential for fleece traits. Anecdotal evidence suggests the breeder's fleece data have improved, although insufficient time has lapsed to make valid conclusions.

A further benefit of tracking profiles with crias is that it places the micron and SD into a perspective. A cria might have a higher than expected micron due to the influence of very high nutrition from the female, or conversely, be low due to lack of nutrition. Also, the SD might be unexpectedly high due to the 'environmental' influence from significant variation along the fibre due to dramatic increases in the profile. All these issues are observable from the Fibre Growth Profile.

References

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