SO WHAT IS THIS SRS® STUFF ALL ABOUT?

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Well, the story goes back a long way. Australian sheep farmers figured out years ago that in order to make more money from wool, they had to either increase the number of sheep they owned, or increase the productivity of each sheep.

Increasing the number of sheep meant increasing costs, such as feeding, shearing, and drenching, since these costs are based on the number of sheep a farmer runs. These increased costs would erode any increase in profits made by selling more wool.

So logically, they looked at ways of increasing the productivity of each sheep, without increasing their overheads.

More wool = more money.

Obviously, the more wool each sheep produces, the more money the farmer makes, but there was more than just quantity to consider. There was the important issue of the quality of wool which the sheep produces. Quality refers to a wide range of wool attributes with which we, as alpaca breeders, are all familiar. Fineness, lustre, uniformity of colour and micron, tensile strength, and crimp are some of those qualities.

But in determining what the market was actually prepared to pay for, fineness was the overwhelming consideration in determining how much was paid per kilogram of fleece.

So one group of farmers set about increasing the quality of their wool, and bred sheep with finer and finer fleeces, for which the market was prepared to pay top price. But it soon became apparent that the finer the fleece, the less it tended to weigh, so these farmers were producing lower quantities of higher quality wool, with the result that their profits did not increase nearly as much as they had hoped.

Another group of farmers chose to concentrate on quantity, breeding for high-cutting fleeces. The trouble was, the higher the fleece weight, the coarser the wool tended to become, and the increase in quantity was offset by lower prices for poorer quality fleece.

Yet another group tried to select for both fineness and fleece weight simultaneously, but found every time they selected for one, they selected against the other. After years of selective breeding, they remained about where they started, without any change in their overall profit or herd profile.

Another group gave up all together: some moved on to meat sheep, a few took up politics, and some just went mad. Some did all three.

Research observation, skin deep.

In the mid 1980's, a vet called Dr. Jim Watts was doing research on the fibre characteristics of sheep at the CSIRO, when he observed that different sheep showed differences in their microscopic skin structure.

He noted that the "follicles", structures from which the wool fibres grow, varied significantly in diameter and arrangement between animals. In all animals, the follicles were clustered together in "follicle groups", the basic unit of fleece structure beyond the individual fibre, and these follicle groups were repeated throughout the skin of the animal. But just as the individual follicles varied between animals, so too did the follicle groups. Some sheep had many more follicles per follicle group, and others had follicle groups which were more closely packed together, which, when combined, produced what he described as "increased follicular density."

It had long been understood that there were two types of follicles. The primary follicle, which is the first to appear in the skin during foetal development, produces a fibre that is generally coarser than its counterpart, grows longer, and is more brittle. In less highly

developed fleeces, it produces a visibly longer and coarser fibre that we recognise as a "guard hair", which is an undesirable feature in woollen textiles. Called variously primary fibre, guard hair or kemp, it is typically a hollow, or “medullated”, fibre. It is the fibre most commonly associated with “prickle” when wool is worn next to the skin. In every follicle group, there are three primary follicles.

The rest of the follicles in a follicle group are called secondary follicles, producing the secondary fibres which appear slightly later in foetal development (hence the "halo" of long primaries surrounding the more numerous and shorter secondary fibres in the newborn). These are smaller diameter fibres than the primaries, but much more numerous. They are generally responsible for all the characteristics that are considered desirable in natural fibre, such as softness, handle, and lustre.

Jim made two profound observations. He noted that follicular density—the number of follicles per square millimetre—varied widely between sheep. Furthermore, the ratio of secondary to primary follicles within a follicle group, the so-called S/P ratio, also showed wide variation between sheep. That is to say, some sheep were producing many more fibres than others over the same area of skin, whilst others were producing many more of the desirable secondary fibres compared to the number of primary fibres.

But that’s not all!

In many instances, the sheep demonstrating these characteristics were one and the same! That is, they were producing more fibres over the same area of skin than comparable sheep, and the increased number of fibres was overwhelmingly in favour of the desirable secondary fibres.

Next, Jim looked at the fleeces of those animals. He was able to identify several visual markers that could enable him to identify those sheep showing increased follicular density and increased S/P ratio.

Firstly, and most importantly, the fibres tended to be finer! So here was a potential solution to the farmer trying to increase productivity by simultaneously increasing fleece quantity (number of fibres) and quality (fineness).

Secondly, they grew faster: at any stage of fleece growth, they were longer than those on grown on animals without the same visual markers: more quantity!

Thirdly, they were extremely soft handling and lustrous: more quality! Jim also noted that the fibres were very highly aligned, and clustered together in thin bundles that were much smaller than the traditional clump, or "staple" as described by wool growers. Closer examination of the bundles showed that the wavy pattern we call "crimp" was much more exaggerated than that which had been traditionally sought after for fine wool, a feature which Jim describes as being both a "bolder" and "broader" crimp.

To better understand this description, one need only think of either a sine curve (for the scientists) or a meandering river (for the canoeists). The rest of you will have to imagine something else.

"Crimp" is basically a repeating waveform. Each wave is characterised by the distance between each consecutive wave (two turns for the canoeists paddling down a meandering river), which is the wavelength, and by the amount which the wave deviates from the line of its general direction, which is the amplitude (how far east or west the canoeist has to paddle in trying to paddle north). These descriptors of wavelength and amplitude are what Jim is referring to when he speaks of "bold" and "broad" respectively. Bold refers to a long wavelength, and broad (or "deep") refers to a wide amplitude.

So why should these broader, bolder crimp styles be finer and grow faster? Well, it has been shown that each crimp takes 8 days to grow in a sheep. So a fibre that has a broader (wider) amplitude and bolder (longer) wavelength has to be longer than one that is tightly crimped, even though it has grown over the same time. Because of the extra space that a deeply crimped fibre takes up, it can only physically do so if it is also highly aligned with its neighbouring fibres. This high degree of alignment produces the lustre, soft handle, and tightly packed fibre bundles that characterize this advanced fleece type. Uniformity of alignment is a predictor of both density and "smoothness": like cars parked in a paddock, you can fit in more cars and create smoother traffic if cars are parked in a pattern than if they are parked at random.

Which brings us back to the sheep breeder. He now knows how, with the help of skin tests, to identify those sheep that will predictably improve both the quantity and the quality of his wool clip. But skin biopsies are a laborious and expensive selection process. How can the average breeder implement these concepts in his breeding programme? Fortunately, Jim Watts has identified visual markers that can predictably identify these advanced animals, and by selecting for and using those animals in a breeding system, the breeder can ensure that he will be improving both fleece quality and fleece quantity with each successive generation.

So what happens as we select increasingly for follicular density?

Well, the argument goes that more and more follicles are packed into a smaller space. As a result, fibres also have to occupy a smaller space, and have no option but to become finer. But if the follicle, the "fibre factory", continues to produce raw materials at the same rate, it has to be extruded faster, resulting in a longer, more rapidly growing fibre. In the meantime, the primary follicles are "feeling the pinch" as they get crowded in by the increasing number of secondary fibres (increased S/P ratio), with the result that they also become finer as they get squeezed by the increasing population of fibres. Eventually (and ideally), the primary fibres match the secondary fibres in fineness, at which point they are no longer undesirable, and contribute to both the quality and the quantity of fleece.

What is the driver for all this? Well (fortunately), you don't have to know. But it boils down to changes in the histology (microanatomy) of the skin as it develops in the foetus and the number and distribution of the cells that will eventually make up the factory floor of the follicle.

And the good news is that this is a highly heritable genetic trait, for which we can now identify the visual markers!

Lastly, I hear you ask, what has this got to do with soft, rolling skin?

Well, Jim coined the term over 10 years ago to describe the kind of skin that was most likely to produce the fleece we have described above. "Soft" and "rolling" were terms chosen to describe skin that was thin, pliable and easily moved over the underlying bone and muscle. It is in contradistinction to the thick and relatively fixed skin seen on many animals and should not be confused with the highly folded skin seen on some sheep, dogs and other species.

Selection for this skin type, when applied together with the visual fleece markers and selective skin biopsies, is the basis of the SRS® Breeding System founded by Jim watts in the early 1990's, a system that has now been extended to include both the Mohair and Alpaca industries.

Where to now?

Well, firstly we need to become familiar with the fleece markers for advanced and elite fleece types. (See companion article in this library written by Dr watts). Then we need to class our own alpacas, to identify those with advanced fleece characteristics. Next, we need to identify and access suitable males to improve on those fleece characteristics. At the same time, we need to be selecting animals with exceptional frames to increase the size and robustness of the animals on which we hope to grow our advanced fleeces, and breeding that frame into our advanced fleece types.

How can you do all that?

Join the many other Australian alpaca breeders that have already signed up to the SRS® Alpacas Australia. Be a part of the development of a distinctly Australian alpaca which is destined to become the international benchmark for the alpaca industry.