APPLYING THE SRS® BREEDING SYSTEM TO ALPACAS

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The SRS® breeding system was developed for fleece-coated animals by Dr. Jim Watts between 1986 and 1988. It is based on the pre-papilla cell research of Moore et al (1998). The working hypothesis is that the extent of wool follicle formation and fibre utput of an animal is determined genetically by the number and activity of the pre-papilla cells (which induce wool follicle formation and fibre growth) in the foetal skin.

The objective of the SRS® breeding system is to increase the density and length of fibres grown by alpacas. If there are many fibres on the animal's body and these fibres are long, then the alpaca will produce a high fleece weight. Also, since high fibre (follicle) density is genetically correlated with low fibre diameter, the fleece will have a high value because it is fine and there is a lot of it.

Fleece structure

An example of the fleece structure of a Huacaya alpaca with measurably high levels of fibre density and length is shown in Figure 1.

In the Huacaya alpaca, high fibre density is indicated by high crimp amplitude (deep crimp) and thin staples. The staple can be as thin as a matchstick and when this occurs, it is referred to as a 'fibre bundle'. High fibre growth rate (long fibres), is indicated by both high crimp amplitude and low crimp frequency ('bold crimp).

In the Suri alpaca, the fibre coils rather than crimps. Consequently the type of fleece that has high fibre density and length is one with long thin staples of deep and well-defined twist (coil) as shown in Figure 2.

Figure 2. The staple of a Suri alpaca with high levels of fibre density and length look likes this.

SRS® is an abbreviation for soft rolling skin. Sheep and goats with high levels of fibre density and fibre length have loose and mobile skins (Figure 3). I anticipate that alpacas will also tend to exhibit this characteristic, perhaps to a lesser degree than sheep and goats, as fibre density and fibre length are improved genetically.

Fibre density

To understand why thin staples with deep crimp are indicative of high fibre density, we need to consider the arrangement of wool follicle and fibres in the alpaca's skin that gives rise to this fleece type. Fibres grow from follicles in the skin. Follicles develop before the cria is born. Primary follicles form first and then secondary follicles. The follicles are arranged as 'follicle groups' (Figure 4).

Figure 1. The fleece structure of Huacaya alpacas with high levels of fibre density and length.

Figure 3. This Angora buck has a loose and mobile skin

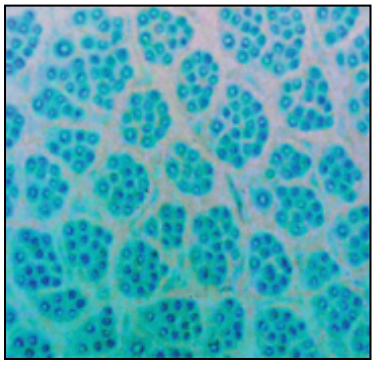

Figure 5. Horizontal skin section (magnified view) of an adult alpaca with a high follicle (fibre) density.

Figure 6. This alpaca's fleece consists

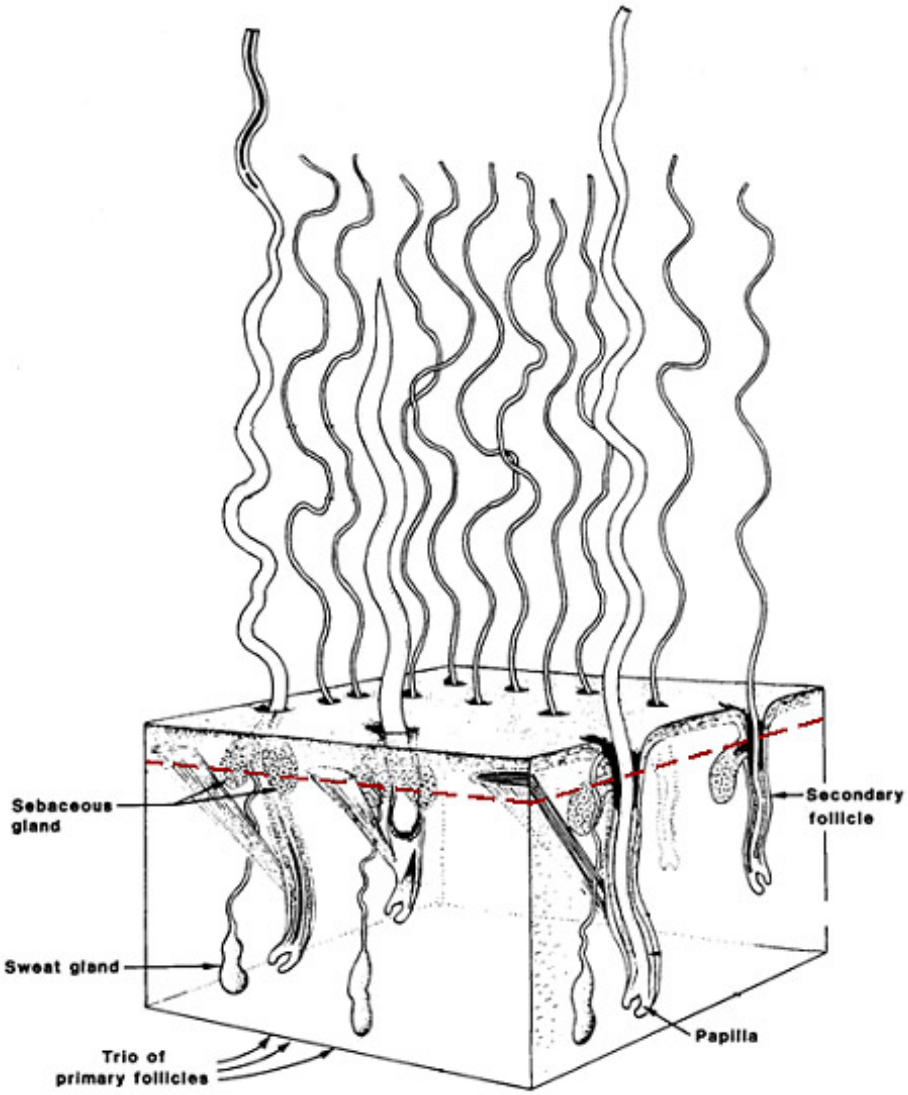

Figure 4. Diagrammatic representation of a follicle group. The dotted line represents the preferred site for cutting horizonyal sections

There are only 3 primary follicles per group. The number of secondary follicles per group is much higher and is a genetic characteristic for a particular alpaca but can vary widely between animals. The S/P ratio, or ratio of secondary follicles to each primary follicle, defines the number of follicles per group.

Figure 5 shows a cross section through the oval-shaped follicle groups of an adult alpaca with high follicle (fibre) density.

The follicle groups are oval shaped and contain wool follicles (blue rings) and wool fibres (white dots within the blue rings). The primary fibres are so fine as to be virtually indistinguishable from the secondary fibres. This is an important point. Primary fibres need to reduced in size (by selective breeding) in order for the number of follicles per group (expressed as S/P ratio) and follicle density (expressed as follicles per square millimetre) to increase. By reducing primary fibre diameter, ‘guard hair’ is also eventually eliminated. Note that in this high density animal, none of the fibres are medullated and all are fine and uniform in size and shape.

The cluster of fibres emerging from a follicle group is called a fibre bundle. Since the follicle group is no more than 1.5 millimetres in diameter, so the fibre bundle is no more than 1.5 millimetres in diameter, that is, much thinner than a staple (Figure 6).

A fibre bundle is likely to form in the fleece whenever the follicles are packed closely together in a follicle group. To ensure that the alpaca produces a high fleece weight of fine diameter and high quality fibre, the follicle group needs to contain a high number of densely packed follicles that are capable of sustaining high fibre growth throughout the alpaca’s life.

Fibre length

In the papilla at the base of the wool follicle (see Figure 3), the original cluster of pre-papilla cells which stimulated the formation of the wool follicle, are to be found. The activity of these pre-papilla cells is thought to control fibre length. Specific signals from the pre-papilla cells stimulate the cells in the overlying follicle bulb to multiply and migrate

upwards to form the wool fibre.

The deep crimp (high crimp amplitude) of the Huacaya fibre is associated with the fibre being composed of hemi-cylinders of paracortex (‘hard keratin’) and orthocortex (‘soft keratin’), or equally balanced bending and buckling forces. The Huacaya fibre crimps, on average, about every 16 days. If the fleece grows further in this 16 day period, that is, the fleece is bolder crimping (lower crimp frequency) it will be longer, particularly if the fibres are deep crimping.

Concluding remarks

High levels of fibre density and length are associated with particular fleece types in alpacas. The staples are thin, never thick or solid, and always deeply crimped, very soft and lustrous. Often, the same fleeces are bold crimping (low crimp frequency), and certainly never ‘fine crimping’ (high crimp frequency) or ‘true to type’.

There is great scope to improve genetically the density and length of alpacas. Both traits could be doubled, bringing a four fold increase in fleece production accompanied by fibre fineness and quality.

Reference

Moore, G.P.M, Jackson, N. and Brown, G. (1998). Pattern and morphogenesis in skin. J. theor. Biol. 191, 87-94.