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Alpaca Breeding - Art, Science or Pure Luck?

By IAN BRAITHWAITE©, World of Alpacas article 2014

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For centuries, the desire to breed the very best animal has proven to be incredibly addictive. How can knowledge of applied genetics be used to breed the alpaca of your dreams? Just what would it take to breed superfine 16 micron alpacas capable of cutting blanket fleece of around four kilograms? The quest for perfection in breeding requires planning, patience and humility. And a fair share of luck!

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To achieve your own vision for the most perfect alpaca ever to be bred, it is necessary to have a plan that sets out what you want to achieve genetically and specifies how you plan to get there. We can break that down into three key steps for improving breeding results:

- developing breeding objectives
- deciding on selection criteria
- knowing how you can influence the rate of genetic progress

Setting your breeding objectives is the first step in designing an alpaca breeding improvement plan. However, before doing this it is important to be aware of what is happening outside one's own business. What is happening in the alpaca market and the natural fibre market more broadly? What are consumers looking for and how is this changing over time?

Breeding challenges we face to remain relevant in a dynamic market

As fibre producers we need to be aware of changes occurring in other natural fibres industries. Arguably our natural fibre competitors are making faster genetic progress than the alpaca industry. For example in 1993/94 only 8.5% of the Australian wool clip was 19.5 micron or finer. Compare this to 2012/13 figures where 40.26% was 19.5 micron or finer and a further 16.75% of the Australian wool clip was core tested to be between 19.6 and 20.5 micron. Cashmere, a much rarer fibre that needs to go through a dehairing process can have a micron as low as 15.5. So its is clear that alpaca is just one of a number of fibres aiming to meet the needs of affluent consumers for luxury, high fashion goods made from natural fibres.

Our individual breeding decisions help determine whether we will lose the battle to re-establish alpaca as 'the fibre of the gods'. What does this mean for breeding? There is a range of questions that need to be carefully addressed. These include how to:

- produce fibre with attributes that processors require
- maintain the advantage provided by the special handle of alpaca which is being threatened by the growing fineness of other natural fibres
- produce volume in natural colours
- determine how low a micron we should aim for with alpaca
- minimise micron blowout
- reduce medullated fibres
- produce higher quantities of more valuable fibre

Coming back to our individual businesses, ongoing genetic improvement is important in our herds for a variety of reasons: our ability to sell animals, matings and fleece, the personal satisfaction that comes from breeding improvements and the thrill of exhibiting prize winning alpacas.

Let's return now to the three main elements involved in designing an alpaca breeding plan and the decisions that need to be made along the way. It is worth keeping in mind that with breeding you can't do everything at once, you need a focus and that "A good animal is one having many good, few indifferent but no bad points".

Developing Breeding Objectives

Setting your breeding objectives is the first step in designing an alpaca improvement plan. Breeding objectives set out what you want to achieve over the next two or three generations of progeny. Consider what traits need to be improved in your herd. Are there traits your alpacas don't already possess and traits you want more or less of in your herd. Which traits should you focus on initially? Examples of fleece traits are high fleece weight, low CV and high fibre length. Animal traits that could feature in breeding objectives include conformation, temperament and jaw alignment. Some traits have a cosmetic value while others have an economic value. Some traits are easier to improve due to a higher heritability level – it is easier to make more progress for reduced fibre diameter as it more heritable than fleece weight. You also need to be aware that some traits may be in conflict with each other e.g. fineness & fleece weight and fineness and length.

The determination of breeding objectives is an individual choice with no one breeder having exactly the same objective. Breeding is a long-term game and we need to look two to three breeding generations into the future, so we can work out what our future customers will value in our animals and fleeces. Here are some examples of different priorities breeders may have and how they can be translated into specific breeding objectives.

- Fibre Value with equal emphasis on increasing fleece weight and reducing fibre diameter. For example, a 1 micron average reduction and 1kg average increase in fleece weight across the entire herd.
- Fibre Quality where reduced fibre diameter is the major aim while fleece weight will be at least maintained at its current level. For example, a 2 micron average reduction across the entire herd while maintaining existing fleece weight.
- Fibre Plus where increased fleece weight is the major aim while fibre diameter will be at least maintained at its current level. For example, a 1.5kg average increase in fleece weight and maintaining existing average micron across the herd.

These particular three examples may take 6-10 years to achieve depending on your investment in time and genetics as well as how you manipulate the four key drivers of genetic gain which will be discussed later in the article. Long-term breeding objectives are critical because they help set our long-term production goals and they allow us to compare the rate of improvement in our breeding program. Finally it is worth noting that certain colours groups within your herd may need different breeding objectives – e.g. blacks v whites and fawns.

Deciding on selection criteria

Once you have set your breeding objectives, the next step is to decide what traits you will use to select the parents of the next generation of progeny. Breeders will have their own preferred set of selection traits. Chosen traits will reflect breeders' views on the usefulness of objective measures such as histograms and confidence in the breeding values generated through the AGE program (Australia & New Zealand) as well as visual and biological assessment methods.

The most common approach used in the alpaca industry and the one most likely to produce the slowest rate of genetic gain is selection on phenotype (what an animal looks like) and histograms (focus on micron). This can be accurate with highly heritable traits. However reliance solely on phenotype means it is very difficult to compare the results of males and females across different herds. The main problem is that it is impossible to separate management practices in different herds from genetic factors.

An alternative approach is to acknowledge we are dealing with thousands of invisible genes and so we need some way of estimating the true genetic merit of our animals. This is done using selection indexes that evaluate the generic merit of animals and close relatives across different herds and countries. The terminology used in each country varies. EBVs (estimated breeding values or alpaca breeding values) is used in Australia, New Zealand and by select breeders in Peru such as Mallkini. In the USA, EPDs (Estimated Progeny Difference) is used. Irrespective of the term used, well-designed programmes allow you to evaluate the genetic merit of progeny with a desired combination of traits based on the performance across different breeder's herds. However it is important to note that while the AGE system has been in operation since 2004, only a minority of breeders ever supported the system. In fact if you did a web search, you would be hard pressed to find any animals for sale or available for outside joining's with publically available breeding values. Furthermore there have not been any new breeding values calculated since November 2011. This situation reflects more local breeder concerns about the design and implementation of the AGE system than a fundamental rejection of the science behind quantitative breeding schemes.

Finally breeders might use a combination of methods – EBVs/EPDs and assessment such as SRS® or the use of multiple measure of fibre diameter across an animal's body.

In selecting traits to focus on you should be guided by a number of considerations:

- the heritability of various traits – it is easier and faster to make progress with more heritable traits
- the variability of the trait within your herd
- the reliability or accuracy of the measurement of various traits across different age groups. Fibre diameter results sampled at weaning or yearling stage are quite variable compared with samples taken at two years of age. If breeders can't be confidant of the breeding values generated by the EBV programme, then obviously they reject the programme.
- the impact that improvement of particular traits will have on fleece and meat values and animal sales.

As mentioned previously fibre diameter and fleece weight are both heritable although often in opposition to each other, that is, in reducing micron you probably may need to sacrifice some fleece weight

Influencing the rate of genetic progress

A breeder's skill and ability to accurately select alpacas with the best breeding values will significantly impact the rate of genetic gain within a herd. Our aim is to identify and select the very best performers and maximise their impact on out herd. As an industry we exert more selection intensity with males than with females. Castration of poor performing males is common. However even here we need to be more discriminating even if we need to travel longer distances to arrange matings or check out superior males.

Most breeders allow all females to pass on their genes. By allowing poor performing female to pass on their genes, you effectively slow the progress of your breeding improvement. One option to maximise performance for highly performing females is too include them in an embryo transfer programs. Females with poor fleece traits but good animal traits of fertility, milk supply and mothering ability made ideal ET recipients. Other choices are to retire females from you active breeding pool.

No matter how well you plan you breeding strategy you will have surprises – both good and bad. However, having a clear vision and a plan to work towards this should improve your breeding progress. But remember:

In life, making plans and acting upon them is important but its vital to dream and believe in your dreams - Frank W. Mitchell