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Mohair Research Update No. 23
----- Entanglement in staples of greasy mohair

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Introduction
Staple entanglement is a fleece attribute that occurs in Angora goats in both Australia and South Africa, and probably elsewhere. Staple entanglement occurs when adhesions form between longer and faster growing fibres and shorter, straighter and slower growing fibres (Figure 1). The adhesions can be skin pieces (scurf or dandruff), wax, suint or mixtures of these products and dust. Once an adhesion has formed it results in the fibres that are growing faster forming exaggerated crimps as they buckle sideways. The process results in the natural crimp (character) of the longer fibres being accentuated as the longer fibres are not free as they are fixed to the skin follicle, and also fixed to the shorter fibre. The longer fibres tend to grow in parallel and this is reinforced by adhesions between these fibres. The result is an accentuated crimp of the longer fibres, and the shorter fibres tend to lose their crimp and become straightened.

In South Africa, mohair selling agents reported that about 30-33% of mohair consigned from the first winter fleece from weaner goats exhibited entanglement of staples (McGregor, 2007). A mohair attribute similar to staple entanglement has been described in South Africa (Du erden and Ross Spencer, 1930). A similar fleece dynamic has been reported in Merino wool which relates to the effects of longer and shorter fibres on the appearance of staple crimp.

Figure 1. On the left is a photograph of a mohair staple with a staple entanglement score of 1, showing the exaggerated crimps in the lower section of the staple. On the right, a stylised mohair staple illustrating how fibres within a staple become entangled when adhesions form between longer faster growing crimped fibres and shorter slower growing fibres which become straightened. Adhesions also form between the longer faster growing fibres.

In both Australia and South Africa, visual inspection is used to assign mohair style grades and staple length category during mohair marketing. Mohair style grading includes a number of staple characters such as the number of crimps or waves per cm, staple lock uniformity, staple style (the number of ringlets or twists per cm), staple tip definition, uniformity of staple length, lustre and dust penetration. This is a serious problem for producers that have mohair with severe staple entanglement because fleeces can be downgraded to the poor style grade during marketing. An assignment of a poor mohair style typically results in a discount of 22% compared with average style mohair, after accounting for other fleece quality attributes.

Furthermore, the accentuated crimp of the longer fibres in entangled mohair results in an apparently reduced staple length. In fact it has been shown that for fleeces with fibres of the same actual straightened length, entangled staples have a much shorter raw staple length. This reduced staple length in raw mohair can lead to fibres being classified as C length (7-10 cm) which leads to a typical discount of 50% compared with longer A and B length mohair. This suggests that mohair with severe staple entanglement may be discounted by up to 60%. Entire farm lots of mohair, which lack uniformity and where the staple crimping of the fleece may be accentuated, and the resultant lock length to appear reduced, have been down-graded to a shorter length class (McGregor, 2002). These issues were of sufficient concern to Australian mohair producers to become a priority focus to improve mohair quality by improved husbandry, clip preparation and a reduction in short fleeces (RIRDC, 1998).

December 2013
Entanglements and adhesions between fibres in mohair lead to increased fibre breakage during early stage processing and reduced processed fibre length (Hunter, 1993). Thus some of the discounting of mohair for severe staple entanglement may be justified. On the other hand, if fibre adhesions are easily removed during normal hot detergent scouring, then discounting is not justified. Either way, with present knowledge, producer Given the importance of mohair staple structure to the classification of mohair style, the economic importance of mohair style in mohair prices, and the effect of staple entanglement on apparent staple length, a study was undertaken on how staple entanglement varies with lifetime factors of Angora goats and how variations in animal size and fleece attributes affect these relationships. Ns need to avoid producing mohair with severe staple entanglement to avoid potential price discounts.

Methods

Angora wether goats born in the sire progeny trial at Horsham in 2002 were grazed until 6 years of age. The goats represented South African, Texan and mixtures of these and Australian genetic sources. The goats were weighed every month and their mohair production and quality was measured at every shearing for 12 shearings as reported in earlier Mohair Updates. Some goats were shorn at 3 monthly intervals or 12 monthly intervals to assess the effect of shearing interval on fleece attributes. A range of objective and subjective evaluations were completed on the mid-side sample prior to testing the sample.

Staple fibre entanglement was scored on 3 staples prior to other measurements. The degree of fibre entanglement and adhesions was scored using a five-point scale:

5. long free fibres easily separated as no adhesions;
4. some adhesions between fibres;
3. some effort to separate fibres as many adhesions;
2. many adhesions, staple fibres entangled, shortening of staple;
1. very entangled and shortened staple, over-crimping evident. Very entangled staples (often called spongy staples) are very shortened due to cross fibre adhesions.

Results

With the exception of fleeces from quarterly shearings, at all shearings there were many fleeces with staple entanglement scores of 3 or below. Fleeces with staple entanglement scores of 3 or below represented 52% of all fleeces examined from shearings other than the quarterly shearing treatment.

Staple entanglement scores were affected by the shearing interval, by the genetic source of the goats, by the season of fleece growth and by the clean washing yield and the fibre curvature (crimp frequency) of the mohair.

Effect of shearing interval, genetic origin and season

Mohair grown by the goats shorn every three months had staple entanglement scores 1.1 higher, indicating lower entanglement, than mohair grown by goats in the other shearing regimes.

Mohair grown by the goats of Texan background in this study had staple entanglement scores about 0.5 lower than mohair grown by goats of South African or Mixed breed indicating greater staple entanglement. This confirms the views of mohair producers, obtained from an industry wide survey, that staple entanglement is more likely in goats of Texan genetic background (McGregor, 2002) although since this time it is likely that there has been selection against staple entanglement within these flocks.

Both of these effects occurred whether or not adjustments were made for fleece attributes.

Generally mohair grown by the goats in winter had staple entanglement scores 0.5 lower, indicating greater staple entanglement, than mohair grown by goats in summer, whether or not adjustment was made for fleece attributes. There were two exceptions to this indicating that in some summers the entanglement may be similar to the winter seasons and some winters may be worse than the average winter.

Effect of fleece attributes, live weight and lifetime factors

Staple entanglement scores were about 0.5 higher for mohair with low fibre curvature (10 °/mm) and a high clean washing yield (90%) compared with mohair with low fibre curvature and lower clean washing yield (80%), and compared with all mohair with higher fibre curvature (18 °/mm) (Figure 2). This suggests that the natural contaminants in mohair, such as wool grease, suint, scurf (skin pieces) and perhaps soil play a role in staple entanglement in mohair with low fibre curvature. For mohair of higher fibre curvature, high clean washing yield did not prevent increased staple entanglement. It is more likely that reducing fibre curvature and increasing clean washing yield through genetic selection, or through maternal means, will have a positive impact on staple entanglement.
There was no evidence that staple entanglement scores were affected by other fleece attributes, such as fibre diameter, staple length, medullation or greasy fleece weight, once the other significant factors as discussed above were taken into account. There was also no evidence that live weight, and live weight change was associated with staple entanglement scores.

Other kid and doe related factors associated with birth, namely kid birth weight, birth parity (single versus twin birth) and weaning weight did not affect staple entanglement score.

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Conclusions
An easy way to almost eliminate staple entanglement is to shear more than twice annually. Unfortunately, this is not likely to be economic except in special marketing situations. Within each shearing, all of the observed systematic variation was due to permanent genetic (or possible maternal) effects on the animal. These effects included responses to breed, clean washing yield and fibre curvature. Nevertheless, these systematic effects only explained a minority of the permanent genetic (or possibly maternal) effects. Mohair producers can manage the genetic effects by careful selection of sires, especially avoiding those with low clean washing yield or high fibre curvature, and avoiding sires with higher levels of staple entanglement or that have produced progeny with higher levels of staple entanglement.

Staple entanglement was greater at winter shearings than in most summer shearings indicating that unidentified environmental effects are affecting staple entanglement, although the lack of a live weight change effect on entanglement indicates that this effect might not be due to nutrition. If the direct cause of these environment effects could be identified, it may be possible to manipulate them to reduce the severity of staple entanglement.

Acknowledgments
Former colleagues and participating farmers are thanked. The Rural Industries Research and Development Corporation and the Victorian Department of Primary Industries provided financial support. Mr Kym Butler is thanked for providing statistical support.

References and further reading
This report is a summary of the following publication:

Other cited references in this article: