TOWARDS 13 MICRONS – BREEDING ULTRAFINE MERINO SHEEP

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SUMMARY
In the current wool market there are very large premiums for ultrafine wools under 16 µm. This has led to a strong interest in increasing production of these wools. CSIRO Livestock Industries has initiated a breeding program intended to develop a flock with an average fibre diameter approaching 13 microns. A consortium involving six ram breeders has been formed to ensure that the genes from the breeding program are disseminated to the industry. The breeding program, initial results, and issues related to processing ultrafine wools are discussed.

Keywords: ultrafine, mean fibre diameter, Merino, breeding objectives.

INTRODUCTION
For many years there have been significant premiums in the auction market for wools classed as superfine and until the last decade these premiums were predominantly based on crimp frequency and style. More recently, measurements of mean fibre diameter (MFD) have become the primary price determinants for superfine (16 – 19 microns, µm) and ultrafine (under 16 µm) wools. Indeed, as Table 1 shows, the premiums between micron categories increase significantly at the finest microns. Although premiums for these wools are very large, production falls dramatically within the finest categories. There is a pattern of increasing but variable production with time in the finest categories. Another feature of the prices received for the finest wools is that the discounts applied to sale lots with lower staple strength, higher vegetable matter content and poorer style, increase dramatically at the lowest micron categories.

Table 1. Prices received (c/kg clean) and greasy weight (kg) of superfine and ultrafine mean fibre diameter wool sold at auction between 1996/7 and 1999/2000

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<tr>
<td></td>
<td>Price c/kg</td>
<td>Weight kg</td>
<td>Price c/kg</td>
<td>Weight kg</td>
</tr>
<tr>
<td>13.5-14.5</td>
<td>22945</td>
<td>1157</td>
<td>23305</td>
<td>1762</td>
</tr>
<tr>
<td>14.6-15.5</td>
<td>4105</td>
<td>23100</td>
<td>2419</td>
<td>37187</td>
</tr>
<tr>
<td>15.6-16.5</td>
<td>1727</td>
<td>513782</td>
<td>1553</td>
<td>585362</td>
</tr>
<tr>
<td>16.6-17.5</td>
<td>1250</td>
<td>2941866</td>
<td>1277</td>
<td>3496566</td>
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units = microns, µm
Source: Merino Ratings Pty Ltd

In 1998, CSIRO initiated the “Toward 13 Micron” (T13) selection program aimed at stimulating an increase in the national production of ultrafine wool and producing even finer sale lots than currently

521
produced. In association with the breeding program, applied and strategic research projects have been initiated, aimed at providing solutions to the technical challenges associated with the processing of ultrafine wool.

This paper describes the objectives and structure of the T13 project, reports preliminary results from the breeding program and discusses wool processing issues that confront those in the industry who are likewise focussed on designing breeding programs for this small but important sector of the wool industry.

THE T13 PROJECT

Background. A primary motivation for this project was to demonstrate to the Merino breeding industry that it was possible to continue to change flocks of superfine sheep, having adult flock averages of 17.5 - 18.0 µm, in a predictable way towards adult flock averages approaching 13µm. The rationale for increasing production of ultrafine wool stems in part from developments in other apparel fibres. In the last 2 decades, the cotton industry has significantly increased production of cotton less than 15µm and more dramatic developments have occurred in the synthetic fibre sector, including production of micro-fibres in the 8 – 12 µm range (Hilton 1995). These fibres are being used in the high quality, low volume niche area that has traditionally been serviced by cashmere and ultrafine wool.

The T13 consortium. The selection program implemented in the T13 breeding flock employs a multiple-trait breeding objective and will produce genotypes useful to the industry. To ensure that ram breeders and wool growers have access to these genotypes, CSIRO sought expressions of interest from fine wool ram breeders to become involved in the project. As a result, the T13 Consortium was formed, as a partnership between CSIRO and six ram breeders. The industry will have access to T13 genotypes initially through the ram breeder consortium members.

Breeding goal and selection strategies. Initially, the goal of the consortium breeding flock was to develop as quickly as possible a ram breeding flock that was as fine as possible, but which maintained clean fleece weight, staple strength, liveweight and reproductive performance at the levels of the foundation flock. To this end, initial selections were based on a 17% micron premium index (which indicates a one micron reduction in diameter increases clean price by 17%). Coefficient of variation of fibre diameter (CVD) was also included in the breeding objective with an economic value equal to one fifth of the economic value for MFD. From the 2001 mating, it was decided to increase the emphasis on MFD by increasing the micron premium to 30%. In addition, staple strength was included as a breeding objective trait with a 5% price premium, replacing CVD. Predicted changes from this objective were reported by Swan et al. (2000a).

Flock structures. The foundation nucleus flock was first mated in 1998 and comprised 308 ewes and 6 rams of mixed age from the breeding flocks of the CSIRO Fine Wool Project (Swan et al. 2000b). These animals were selected on the 17% micron premium index described above. Breeding value estimation used full pedigrees and annual measurements of wool quality and production traits for hogget and adult traits in the index. A repeat mating of these animals occurred in 1999, with the additional use of a sire evaluated within the Central Test Sire Evaluation system (CTSE, Casey et al.
For the 2000 mating, the six breeder consortium members chose 150 ewes from within their own flocks on the 17% index or MFD measurements alone. These mixed age ewes were mated to a top ranked ram from 1998 drop nucleus flock, a ram chosen from the available home bred sires and the external link sire chosen from the CTSE source. This link ram was also used in the nucleus flock in the 2000 mating, together with 7 top indexed rams from the 1998 nucleus cohort.

In Table 2 performance figures of the foundation ewes and first-born progeny from the nucleus flock are reported. The mean production figures for the 1998 drop measured in 1999 were 2.9kg for greasy fleece weight, 2.2kg for clean fleece weight, 15.3µm for MFD and 29.8kg for body weight.

Table 2. Estimated breeding values (EBV) of wool traits and body weight for the foundation ewes and rams (parental) and the 1998 drop progeny relative to the CSIRO Fine Wool Project flock

<table>
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<tr>
<th>Trait*</th>
<th>Parental EBV</th>
<th>Progeny EBV</th>
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<tbody>
<tr>
<td>Greasy fleece weight (%)</td>
<td>5.0</td>
<td>8.2</td>
</tr>
<tr>
<td>Clean fleece weight (%)</td>
<td>6.6</td>
<td>9.4</td>
</tr>
<tr>
<td>Mean fibre diameter (µm)</td>
<td>-0.5</td>
<td>-0.6</td>
</tr>
<tr>
<td>Body weight (%)</td>
<td>3.5</td>
<td>4.6</td>
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* Wool traits measured at 10 months and body weight at 11 months of age

WOOL PROCESSING ISSUES RELEVANT TO ULTRAFINE WOOL BREEDERS

For ram breeders with flocks currently in the superfine range (adult ewe flock averages between 17 - 19µm), but with a breeding goal focussed on re-positioning their flock to produce wools in the below 14.5µm category their clear focus must be on MFD reduction. However, there are other raw wool quality attributes that can have a major impact on processing outcomes and which can be influenced by selection decisions.

Staple and fibre length. Mean fibre length in the top (hauteur) is not only a significant determinant of price in very fine tops, but when below critical values can have a severe impact on the spinning performance of a top. Very high levels coefficient of variation of fibre length of a top can also impact negatively on spinning performance at (Lamb 2000). Measuring fibre length in greasy wool is extreme difficulty and thus little is known about the relationship between fibre length and staple length.

Because of the positive genetic relationship between hogget staple length and mean fibre diameter in fine wool flocks (Purvis and Swan 1998) breeding programs that are focussed on production of ultrafine wool genotypes, need to ensure that their strategies take account of this relationship and the downstream processing considerations. Further studies, such as those reported by Purvis and Swan (1998), that relate raw wool traits to processing performance, are needed to ensure that appropriate selection emphasis is achieved in selection programs.

Pilling and shrinkage. CSIRO have conducted a study (Robinson 1999) that evaluated whether ultrafine wool (14.7µm) offers any significant product advantages beyond those found in superfine...
wool (16.8µm) and establishing whether there were any particular problems in processing ultrafine wool batches. Across a range of different products the wearer trials showed the ultrafine products were always favoured over the superfine. However, there was significant higher levels of pilling and dry felting in the knitwear made from the ultrafine wool. Further studies are required to understand the causes of these problems. Solutions may come from changes to processing procedures, and in the longer term from genetic manipulation of fibre attributes.

CONCLUSIONS
Any breeding program that seeks to breed animals for niche markets where price volatility is the norm, faces the dual challenge of having a bigger risk of being incorrectly positioned in the longer term and seeing price premiums diminish as production increases.

In the case of the development of an ultrafine Merino flock, the risk is reduced by the ready availability of broader and heavier cutting flocks should the premiums for ultrafine wool significantly diminish or evaporate entirely.

However, there remain particular challenges for breeders of ultrafine genotypes because of a small market and limited buyers. There is also limited public-held knowledge of factors influencing processing efficiency and product quality in this niche market. For those breeders who can achieve the genetic change necessary for the product from their commercial flocks to be differentiated in the market, there is the offer of significant economic rewards. The T13 project is an initiative involving breeder, scientist and processor from the very beginning of the breeding program and, as such, offers the hope of delivering a product for which there is strong long term demand.

REFERENCES


