RESPONSE TO SELECTION METHOD ON VISUAL TRAITS IN SOUTH AUSTRALIAN MERINO SHEEP

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SUMMARY
We studied data from the Merino Selection Demonstration Flocks (SDF) to identify the effect that selection techniques using differing emphasis on objectively measured criteria have had on subjectively assessed traits. The performance of three key subjectively assessed traits, conformation, wool colour and wool handle are reported as genetic changes over time, based on assessments of hogget offspring born between 1997 and 2004. Two professional classers scored the traits independently and these are also reported separately. There were no meaningful differences in conformation between any of the flocks, including the control, or between the conformation assessments of the two classers. Wool colour had an initial lift in breeding value in the selected lines in the first two years of the project. In contrast, wool handle genetically improved in all the selected flocks over the life of the project. In conclusion, we could find no evidence that direct selection for objectively-measured traits by industry-based committees led to unfavourable genetic changes in conformation, wool colour and wool handle, as assessed by professional classers.

INTRODUCTION
Many traditional wool producers are concerned that selection based on objective traits may degrade visually assessed subjective traits considered important to the productivity and profitability of their flocks (e.g.Vizard and Hansford 1999). These concerns may have contributed to the low adoption of objective measurements in wool sheep breeding programs in the past. To investigate these concerns, we studied Merino Selection Demonstration Flocks (SDF) data (Ponzoni et al. 1999) to identify the effect that using selection techniques with differing emphasis on objectively measured traits have had on genetic change for a range of subjectively assessed traits. The paper discusses results for traits recorded on hogget offspring born between 1997 and 2004.

MATERIALS AND METHODS
Selection Flocks. The selection lines studied are described in detail by Ponzoni et al. (1999) and Ingham and Ponzoni (2001). The SDF project was established in South Australia in 1996 to highlight the strengths and weaknesses of the three prevailing selection approaches used by industry, these being selection by measured performance and quantitative genetics (MPR), visual and tactile appraisal by professional sheep classers (PCA) and the Elite wool or ‘soft rolling skin approach’ (EWF). An unselected line was established as a control (CON). The Fibre Meat Plus (FM+) line was added in 1999, to develop a Merino more suitable for meat production whilst maintaining high quality wool. Importantly, breeding and selection decisions for each of the selection lines were driven by industry participants including practising ram breeders, wool growers and sheep classers.
Measurements/assessments. Many traits are recorded within the SDF flocks (Ponzoni et al. 1999), but only three key subjectively assessed traits are reported here, all with mean values of 2 to 3;
conformation (1 = poor, ..., 5 = good overall structure), wool colour (1 = yellow, ..., 4 = lustrous white) and wool handle (1 = harsh, ..., 5 = very soft). Subjectively assessed traits were recorded by two professional wool classers, working independently (prior to hogget shearing) and were similarly analysed as measurements from Classer 1 and Classer 2. Other traits were not reported as they gave similar results to conformation (front and back leg assessments, proportion of “tops” and “culls” and non-wool pigment) or wool handle (wool cover, wool condition and skin quality), gave conflicting results between classers (lock) or were not scored by the classers (wrinkle scores).

**Data Analyses.** An animal model was fitted using ASREML (Gilmour et al., 2000). The fixed effects were sex, type of birth and rearing, year of birth, day of birth within year and the interaction between year of birth and flock, which quantifies genetic change over time.

**RESULTS**

Genetic changes over time, plotted as breeding values (BV), are shown for the following subjectively assessed traits, conformation (Figure 1), wool colour (Figure 2) and wool handle (Figure 3) for Classer 1 and Classer 2. Note that the breeding values in Figures 1-3 are scaled such that the control line commences at zero.

![Figure 1. Genetic change over time in conformation for Classer 1 and Classer 2](image)

For the three traits, conformation, wool colour and wool handle and for assessments by both Classers, the control flock remained genetically constant from the birth of the first progeny in 1997 to those born in 2004. Further, for wool colour and wool handle, the initial advantage of the selected flocks over the control flock can be attributed mainly to the use of outside sires in those flocks to breed progeny born in 1997 and 1998.

There were only small fluctuations over time in conformation and no real differences in breeding values between any of the selection flocks, or between the breeding value estimates based on the assessments of the two classers.
For wool colour, there were small genetic differences between the selected flocks, with all flocks making improvement in progeny born from 1999 to 2001, but by the time of assessment of progeny born in 2004, breeding values were back to similar levels of those for progeny born in 1997. There were only minor differences in assessments of wool colour between the two classers.

Figure 3. Genetic change over time in wool handle for Classer 1 and Classer 2

For wool handle, both classers assessed that selected flocks had genetically improved over the life of the project, more so for Classer 2, with the largest improvements of 1.7 score points occurring in each of the EWF and MPR lines.

DISCUSSION
Whilst considerable genetic improvement has been made in key traits such as fleece weight (up to 0.5 kg in breeding value) and mean fibre diameter (a reduction of up to 2.3 µ in breeding value) in the Selection Demonstration Flocks (Kemper et al. 2006), there has been little genetic change in
subjectively assessed conformation and wool colour, except for an initial improvement in wool colour from the use of outside sires in the first two years of the project. Nor were there any meaningful differences detectable in conformation and wool colour as a result of use of the three selection methods, represented by the MPR, PCA and EWF lines. Notwithstanding, using a within-year analysis, the FM+ line was significantly better (both classifiers) than all other flocks for conformation in the 2004-born progeny (Brien et al. 2006). In contrast, breeding values for wool handle have improved throughout the project, especially in the EWF and MPR lines. This is consistent with genetic improvements in mean fibre diameter and in fibre diameter distribution (Brien et al. 2006).

These findings are contrary to the perception that selection largely based on objectively measured traits, as used in the MPR and FM+ flocks, may degrade subjectively assessed subjective traits considered important to the productivity and profitability of producers flocks. We believe the reason there was little genetic change in conformation was that all the selection lines had as part of their breeding objective both decreasing fibre diameter and increasing body weight. In our study, conformation was genetically correlated with both mean fibre diameter (0.48 and 0.39 for Classer 1 and 2, respectively) and body weight (0.60 and 0.73 for Classer 1 and 2, respectively), so any correlated changes in conformation that could have arisen from genetically reducing fibre diameter were likely negated by applying a multi-trait selection strategy incorporating body weight.

In conclusion, the SDF project, whilst demonstrating that substantial genetic improvement can be made in objectively-measured traits such as fleece weight and fibre diameter, could find no evidence that direct selection for these traits by industry-based committees led to unfavourable genetic changes in conformation, wool colour and wool handle, as assessed by professional classifiers.

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REFERENCES