

## SELECTION DEMONSTRATION FLOCKS - WHAT HAVE WE LEARNT?

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### SUMMARY

The 2002 and 2003 progeny results for key traits from the Selection Demonstration Flocks (SDF) project are presented. Long-term responses to selection are also discussed. Established along with an unselected control flock (CON) in 1996, the original three selection flocks emphasise use of either measured performance (MPR), professional classer assessment (PCA) or an elite wool or 'soft rolling skin' approach (EWF). A Meat Merino flock was added in 1999 (FM+). All SDFs are outperforming the CON. Commencing with the 2001-drop, considerable divergence between the selection flocks was observed for mean fibre diameter and fleece weight; since that time divergence in mean fibre diameter has not increased, whereas the MPR, EWF and PCA flocks have tended to converge again for fleece weight. Most of the initial advantage in 16-month live weight in the FM+ flock over the CON has been retained in later years, whilst achieving small increases in fleece weight and maintaining a lower mean fibre diameter.

**Keywords:** Selection demonstration flocks, Merino, selection approaches

### INTRODUCTION

In 1996, the Selection Demonstration Flocks (SDF) were established in South Australia to highlight the strengths and weaknesses of the three prevailing selection approaches used by industry (Ponzoni *et al.* 1999). These approaches were 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). A further two selection lines have been added, one for breeding a Merino more suitable for meat production, whilst maintaining high quality wool (FM+ flock, Ingham and Ponzoni 2001) and the other, for producing fine wool in a traditionally medium to strong wool environment (the Fine Wool Flock – Ramsay *et al.* 2004).

The purpose of this paper is to provide a short account of the SDF project and discuss the key implications of the findings obtained to date. Results are shown for the sixth (2002) and seventh (2003) drops from the original flocks and the third and fourth drops of the FM+ flock. No further account is given of the Fine Wool Flock, because of its different origin and management.

### MATERIALS AND METHODS

Details of the establishment and management of the SDF flocks, and the traits recorded, are given by Ponzoni *et al.* (1999), Ingham and Ponzoni (2001) and Ramsay *et al.* (2003, 2004). Briefly, the breeding objective of the original SDFs is to improve profitability of the South Australian Merino. This translated into maintaining or slightly improving fleece weight and body weight and greatly

improving wool quality by reducing mean fibre diameter and improving style. The objective of the FM+ flock is to improve live weight and carcase traits whilst reducing fibre diameter and maintaining fleece weight, using measured performance and visual appraisal. The data were analysed by restricted maximum likelihood (REML), using a sire model, with flock means adjusted for the effects of type of birth and rearing, age of dam and date of birth, and sex.

**RESULTS AND DISCUSSION**

Table 1 shows the hogget performance of the SDF progeny born in 2002 & 2003, for clean fleece weight (CFW), mean fibre diameter (MFD), staple strength (SS) and 16-month live weight (16 mo LW). The 2003-drop represent 7 years of selection in the original SDFs and 4 years in the FM+.

**Table 1. Least square means of hogget clean fleece weight (CFW), mean fibre diameter (MFD), staple strength (SS) and 16 month live weight (16 mo LW) for 2002 and 2003 SDF progeny. Means with unlike superscripts differ significantly (P<0.05). Deviations from the unselected control flock (CON) are in brackets**

FLOCK	CFW (kg)		MFD (µm)		SS (N/ktex)		16 mo LW (kg)	
	2002	2003	2002	2003	2002	2003	2002	2003
CON	4.25 <sup>b</sup>	4.24 <sup>b</sup>	21.25 <sup>a</sup>	20.82 <sup>a</sup>	31.38	35.15 <sup>ab</sup>	60.74 <sup>bc</sup>	58.53 <sup>b</sup>
MPR	4.61 <sup>a</sup>	4.46 <sup>ab</sup>	18.87 <sup>cd</sup>	18.45 <sup>c</sup>	31.05	32.76 <sup>b</sup>	58.01 <sup>c</sup>	54.05 <sup>c</sup>
	(+0.36)	(+0.22)	(-2.38)	(-2.37)	(-0.33)	(-2.39)	(-2.73)	(-4.48)
PCA	4.48 <sup>ab</sup>	4.41 <sup>ab</sup>	19.35 <sup>bc</sup>	18.87 <sup>bc</sup>	30.18	30.70 <sup>b</sup>	62.46 <sup>ab</sup>	58.14 <sup>b</sup>
	(+0.23)	(+0.17)	(-1.91)	(-1.95)	(-1.19)	(-4.45)	(+1.72)	(-0.39)
EWF	4.60 <sup>a</sup>	4.52 <sup>a</sup>	19.79 <sup>b</sup>	19.15 <sup>b</sup>	30.79	38.91 <sup>a</sup>	62.98 <sup>ab</sup>	58.55 <sup>b</sup>
	(+0.35)	(+0.28)	(-1.47)	(-1.67)	(-0.59)	(+3.76)	(+2.24)	(+0.02)
FM+	4.23 <sup>b</sup>	4.36 <sup>ab</sup>	18.49 <sup>d</sup>	18.48 <sup>c</sup>	29.43	33.55 <sup>b</sup>	64.94 <sup>a</sup>	62.28 <sup>a</sup>
	(-0.01)	(+0.12)	(-2.76)	(-2.34)	(-1.95)	(-1.60)	(+4.20)	(+3.75)

Hogget CFW has improved in the SDFs, with the EWF and MPR significantly higher than the CON for the 2002-drop, but only the EWF was significantly higher for the 2003-drop. In both years, all selection flocks were significantly lower in hogget MFD than the CON, with the MPR and FM+ flocks significantly finer than the EWF, but not the PCA. For the 2003-drop, SS was significantly higher in the EWF than in the MPR, PCA and FM+, but no flock was significantly different to the CON. There were no significant differences among the SDFs in SS for the 2002-drop. For the 2003-drop, the FM+ was significantly higher and the MPR lower than the other flocks in 16 mo LW. Similar results in 16 mo LW were obtained for the 2002-drop, the only variation being that the MPR was not significantly lower than the CON in that year.

Figures 1 and 2 show the differences in hogget CFW, MFD, SS and 16 mo LW, respectively, for the SDF flocks since establishment. All graphs are shown as phenotypic deviations from the CON. Despite an improvement in CFW from the 1997 to the 1999-drop, relative to the CON, CFW in the EWF and MPR in the 2003-drop are now similar to that of the 1997-drop (Figure 1A). The PCA has remained similar in CFW since the 1997-drop. Since its first progeny were born in 2000, the FM+ has steadily improved in CFW. The original SDFs all achieved a reduction of 2 µm in MFD by the

2000-drop compared to the CON, but only the MPR has since exceeded this advantage (Figure 1B). Divergence in MFD between the original SDFs was at its highest of 1.06  $\mu\text{m}$  in the 2001-drop. The FM+ was 1.76  $\mu\text{m}$  to 2.76  $\mu\text{m}$  lower in MFD than the CON over the 4 years since establishment.

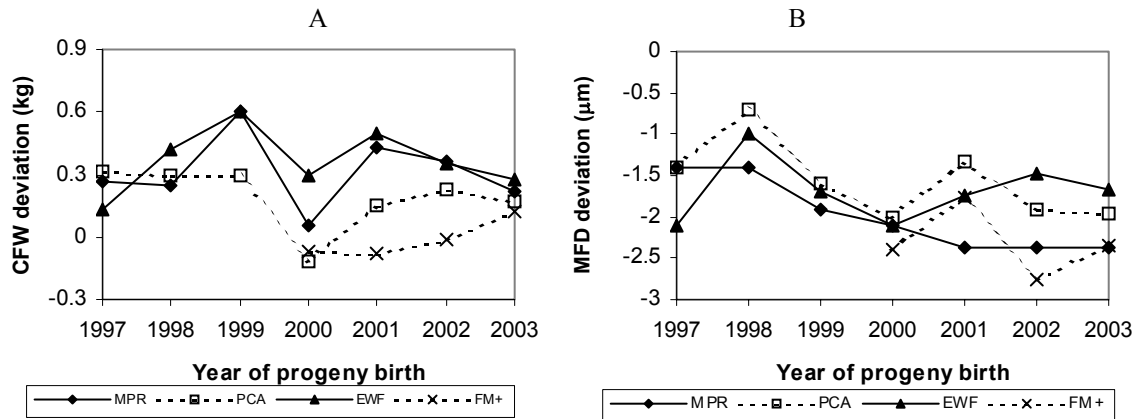


Figure 1. *A.* Hogget clean fleece weight (CFW, kg) and *B.* mean fibre diameter (MFD,  $\mu\text{m}$ ) deviations from the unselected control over time.

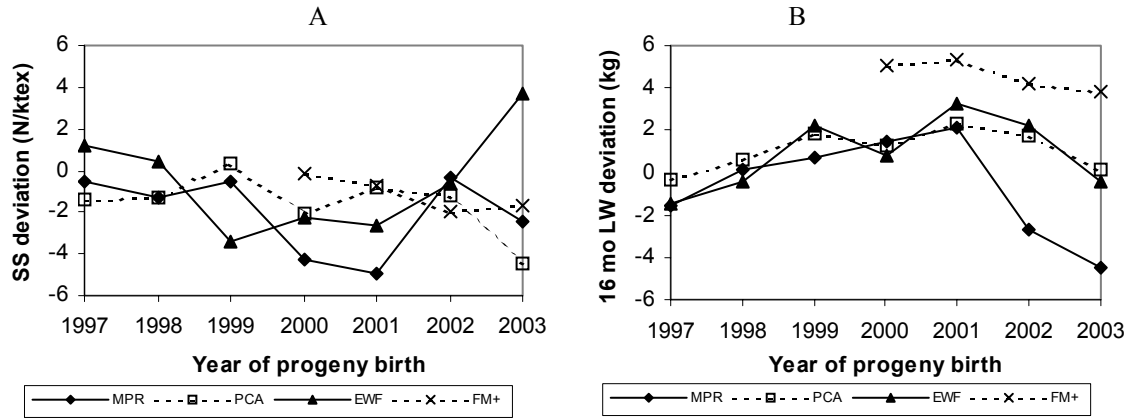


Figure 2. *A.* Hogget staple strength (SS, N/ktex) and *B.* 16-month live weight (16 mo LW, kg) deviations from the unselected control over time.

Following the poor results of the 2001-drop, the MPR committee increased selection pressure on SS, with the results of the 2002-drop reversing the downward trend for SS in the MPR (Figure 2A). The EWF have improved SS since the results for the 1999-drop. For the 2002 and 2003-drops, relative to the CON, 16 mo LW for the MPR has fallen, whereas the PCA and the EWF have largely achieved

their objective of maintaining live weight (Figure 2B). Since establishment, the FM+ have consistently had heavier progeny at 16 months of age than the CON.

With respect to the dwindling of selection response in the original SDFs since the 2001-drop, it is unlikely that selection plateaus have been reached, as previous selection trials have demonstrated responses continuing for decades (Turner 1977). Furthermore, as exemplified by the MPR committee putting more emphasis on staple strength in the last 2 years, SDF selection committees may have made other adjustments to the emphasis placed on traits since setting their original breeding objectives. Such changes, if made, are likely to affect genetic gain in other traits.

The following key conclusions can be drawn from the SDF project results to date:

- All SDFs are outperforming the control. Regardless of the selection system applied, with a clear breeding objective, it is possible to significantly improve productivity. Genetic reductions in MFD have been made in all SDFs, without sacrificing fleece weight.
- The level of divergence between the selection flocks observed for the 2001-drop (Ramsay *et al.* 2003) has not been maintained for fleece weight, with the MPR, EWF and PCA tending to converge again for CFW, although for MFD, the MPR and FM+ were still significantly lower than the EWF for the 2002 and 2003-drops.
- The FM+ flock is performing well in MFD and CFW, whilst displaying higher live weight than the original SDFs and control flock. Most of the initial advantage of 5.1 kg in 16 mo LW in the FM+ over the control flock for the 2000-drop has been retained in later years, whilst achieving small increases in CFW and maintaining a lower MFD.

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