GENETIC IMPROVEMENT IN THE SA SELECTION DEMONSTRATION FLOCK AND AT SEAMOUR STUD – A PRODUCER’S VIEW

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SUMMARY
The Measured Performance Recording flock and the Seamour stud have been “Making it Happen” with quantitative genetic improvement. The Measured Performance Recording (MPR) flock was part of a Selection Demonstration project that compared different selection methods in Merino sheep. After 7 years of selection the MPR was $2.10/DSE (dry sheep equivalent) more profitable than the Professional Classer Appraisal (PCA) flock and $6.40/DSE more profitable than the Elite Wool Flock (EWF) (Brien and Young 2006). Seamour stud master, Bill Richardson, was one of the performance breeders who selected sheep for the MPR flock.

A Sheep Genetics Australia 7% Dual Purpose Index has been calculated for Seamour sheep. Progressive selection systems have improved the Seamour flock (poll stud flock number 1291). During years of selection by measurement, without Australian Sheep Breeding Values (ASBVs), the flock improved by 2.0 index points per year. In the time measurements were transformed to ASBVs the flock gained at 3.5 index points per year and with the addition of Total Genetic Resource Management (TGRM) as a selection tool the flock improved at 4.9 index points per year.

CASE 1 – THE SELECTION DEMONSTRATION FLOCK
In 1996 a group of wool and sheep industry people decided to establish a demonstration project to determine the differences in selection methods that were current at the time. Four flocks of 200 ewes each were run by South Australian Research and Development Institute (SARDI).

Three groups of industry people were responsible for selection by measured performance recording utilising quantitative genetics (known as MPR), professional classer appraisal using visual judgment with some measurement (PCA) and a “soft rolling skin” or “elite wool” flock (EWF). The common aim of each flock was to improve profitability of the South Australian Merino. A fourth flock (Control) was run as a genetically stable flock to quantify the degree of genetic change made by each flock.

Rams from across Australia were used in the first 2 years in each selection flock. The flocks were then closed to outside genetics and bred from their own replacements. Each lamb was pedigree recorded. LAMBPLAN assessors recorded carcase traits, wool measurements were taken and worm egg counts recorded. The sheep were visually assessed by two independent sheep classers.

The MPR group selection emphasis was 80% on measured assessment and 20% on visual appraisal of traits. The PCA group used 100% of its selection emphasis on visual appraisal when selecting ewes and 80% on visual appraisal and 20% on measured assessment of traits when selecting rams. The EWF group used a combination of wool and skin type appraisal with some measured assessment when selecting rams and ewes. MPR had Estimated Breeding Values (EBVs) compiled to assist in selection of both rams and ewes. During the final two years the MPR group used TGRM to produce a mating list that provided optimum genetic gain while limiting the effects of inbreeding. The EWF group used meticulous matching of sire and ewe characteristics to decide on mate choices.
Adoption

CASE 1 – MPR RESULTS
The MPR was $2.10/DSE more profitable than the PCA and $6.40/DSE more profitable than the EWF, based on Net Present Value. For a typical nucleus of 500 breeding ewes and 21,000 commercial ewes, over a 15 year period, this equates to $112,000 and $341,000 more return from MPR than the PCA and EWF, respectively (Brien and Young 2006). They (Brien and Young 2006) showed that the MPR flock had the highest cost of selection. The cost became relatively unimportant when genetic gain is being achieved in the economically important traits and is spread across a large commercial flock. If one was to extrapolate that over the Australian flock a push for a MPR style selection would be irresistible.

The most significant reason for the MPR being most profitable was the degree of fibre diameter reduction achieved (Figure 1). The MPR flock achieved a significantly higher reduction in fibre diameter than the PCA and EWF. The PCA group had a sire selection differential almost as great as the MPR. The MPR ewe replacements were objectively selected for fibre diameter reduction as well as the rams. An 8% index was used to select all MPR sheep.

Figure 1. Genetic trend for mean fibre diameter in the Selection Demonstration Flocks (adapted from Brien et al. 2006).

The MPR flock increased clean fleece weight at the same time as achieving fibre diameter reduction (Brien et al. 2006). MPR flock ended up with a significantly heavier fleece weight than PCA and heavier than EWF, but not significantly. While MPR improved in the economically important traits the flock also had the best assessment for most wool traits for the 2004 drop and achieved similar skin quality to the EWF (Brien et al. 2006).
CASE 2 – SEAMOUR STUD

The Seamour ram breeding flock commenced in 1978 as a group breeding scheme. Initially rams were measured and selected for clean fleece weight, fibre diameter and yearling live weight. In 1990 Seamour entered the Western Australian Sire Referencing Scheme to benchmark the flock’s standard. The scheme required sire pedigree of the offspring involved. Since 1990 most lambs have had sire pedigree, at least, recorded.

A major step forward occurred in 1998. The Seamour flock joined Merino LAMBPLAN, the pedigree of both sire and dam was recorded, weaning weights were taken, LAMBPLAN assessors measured eye muscle, fat depth and scrotal circumference and individual worm egg counts were taken. A year later the wool samples were also measured for staple strength and staple length. The regular measurements of fleece weight, wool measurements and live weight recordings continued. All the sire pedigree and measured data from the records back to 1990 were entered into the Sheep Genetics Australia (SGA) database. ASBVs have been calculated by SGA, and its predecessors, for all sheep from 1990 to the current drop.

The ram and ewe matings from 2001 until the present joining have been allocated by a software program, TGRM, which is a program that optimizes genetic gain while limiting the effects of inbreeding. More information on TGRM can be obtained from SGA. TGRM has been licensed to Elders Ltd as Breed Exact®.

CASE 2 – SEAMOUR PROGRESS (AND PROBLEMS)

An SGA 7% Dual Purpose Index has been calculated for all years used in the comparison. During the early years of selection from 1990, when measurement was extensively used, the flock improved by 2.0 index points per year (this figure is derived from ASBVs generated from data that was incorporated into SGA some years later). From 1998 the measurements were transformed to ASBVs. Accuracy of the ASBVs is high due to the pedigree recording of both sire and dam. Other traits are measured which provided extra correlated information. The flock gained at 3.5 index points per year during that time. TGRM was introduced as a selection tool from 2001. The flock then improved at 4.9 index points per year (Figure 2).

Figure 2. Seamour stud 7% Dual Purpose index averages by year.
Problems were created when traits were not measured or observed. Both the Seamour flock and MPR flock reduced fibre diameter and increased fleece weight. At the same time staple strength suffered a reduction in both flocks. Remedial action was taken as soon as the problem was noticed and identified. MPR group members had to select within their flock which limited their progress. However, high staple strength sires were introduced to and identified at Seamour and the staple strength has turned around quickly (Figure 3).

**Figure 3.** Seamour fibre diameter ASBVs and staple strength ASBVs by year.

**CONCLUSIONS**
- Have a clear breeding objective that is flexible to change with market influences e.g. the meat market has improved during the last decade.
- Measurement is more accurate than visual appraisal, but do not exclude visual classing.
- Use breeding values to make selection much more accurate.
- Use TGRM. This could double the rate of genetic improvement.
- Maintain good records. Breeding values calculated annually will indicate the genetic merit of sheep, within the flock and across Australia, and reveal if the flock is improving.

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**REFERENCES**