

# Sheep Improvement Limited eight years on

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## Introduction

Sheep Improvement Limited (SIL), the performance recording and genetic evaluation service for sheep in New Zealand, was described by Cruickshank *et al.* (2002) and Newman *et al.* (2002) eight years ago to this congress. Since that time the SIL system has grown and developed. This paper describes changes that have occurred in SIL and considers what lies ahead for the SIL system in order to maintain industry relevance.

## Growth of the SIL database

SIL has grown its database. In early 2010 there were ten million animals (six million in 2002) and one billion breeding values (BV; one hundred million in 2002), making it the largest genetic database for sheep in the world based on number of animals. There has been a small increase in the number of active flocks to c.750 (c.700 in 2002). In addition, the database is now used for performance recording by deer breeders and for pedigree-only recording of c.350 sheep and goat flocks.

For performance recorded, dual purpose type sheep flocks, median flock size increased from 483 (maximum 5820) to 592 (maximum 7919) since 2002 (Young & Wakelin 2009). Equivalent figures for terminal sire type flocks saw median size increase from 171 to 212 (maximum decreased from 2381 to 2037).

Just under two thousand genetic evaluations were performed in 2009 for individual flocks or groups of flocks. There has been a trend for more flocks to participate in across-flock evaluations. The largest is SIL-ACE, an across flock, across breed evaluation of 330+ flocks and >3.2 million animals, which was described by Young & Newman (2009).

## Development of the SIL evaluation system

Building on the Growth, Meat, Wool, Reproduction, Lamb Survival and Internal Parasite Resistance modules in place in 2002, SIL has added recording and genetic evaluation modules for Carcass Lean Meat Yield, Twinning (higher proportions of twin births at the same flock reproductive rate), Hogget Lambing (optimized analysis of reproductive data for ewes lambing at 1 year of age), Fine Wool, Wool Quality, Internal Parasite Resilience, Dag Score and Facial Eczema Tolerance. In addition, SIL has recently introduced recording protocols for Ewe Longevity and Fleece Bareness but does not yet conduct genetic evaluations for these traits.

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Evaluation modules for Growth and Lamb Survival were upgraded to a maternal effects model to estimate mothering ability (maternal lamb survival BV) and milking ability (maternal weaning weight).

Early in 2010, SIL implemented a major revision of its Growth and Meat evaluation modules to improve the estimation of genetic merit for Adult Size and to shift the focus of carcass merit to carcass Meat Yield.

The SIL system facilitates pedigree and BV information export to an external service provider for commercial delivery of mate selection and mate allocation services (e.g. [www.abacusbio.co.nz/AbacusAccelerator.html](http://www.abacusbio.co.nz/AbacusAccelerator.html)). DNA parentage systems can be integrated into SIL genetic evaluations where flocks use the Pfizer Animal Genetics **Shepherd**<sup>®</sup> DNA parentage service (details available at [www.pfizeranimalgenetics.com.au](http://www.pfizeranimalgenetics.com.au)).

There has been a substantial growth in the use of across-flock genetic evaluations since 2002. Breeders appoint Across Flock Report Managers to manage evaluations for their flock group and report on genetic connectedness. Auditing tools have been developed for Reproduction and Lamb Survival traits as this data is difficult to assess for quality and to identify problems affecting across flock genetic connectedness. They also facilitate inspection of data as part of routine quality assurance for data handling. Other traits can be audited using simpler tools.

Genetic Trend Graphs can now be produced with more user customization. One feature is the plotting of individual flock lines with breeding group average lines.

## Impact of SIL on industry

We estimate that 85% of rams sold in New Zealand come from flocks which have SIL information available for ram purchasers. This high degree of industry penetration requires SIL to be adaptable and to maintain a close eye on developments that can enhance its relevance to industry.

The SIL language is accepted by a significant proportion of the ram breeding industry. There remains scope for increasing understanding of the SIL system among those working in the ram buying industry. This is an important focus of current SIL work.

Estimates of the rate of genetic gain achieved by SIL flocks were presented by Amer (2009) and by Young & Amer (2009) based on analysis of data from the SIL-ACE genetic evaluation (Table 1). This work showed that in the early years of SIL, genetic gains were close to double of those achieved prior to the establishment of SIL in 1999 and gains increased further after establishment of the SIL-ACE evaluations in 2003. Such increases were

**Table 1: Average rates of genetic gain for two sheep types in four time periods for an economic index (cents per ewe lambing per year)**

Period	Dual Purpose sheep	Terminal Sire sheep
1990-1994	23	23
1995-1998	29	20
1999-2003	54	35
2004-2006	84	48

attributed to SIL providing more accurate BVs for key traits (*e.g.* number of lambs), increased breeder confidence in SIL figures and, with the advent of SIL-ACE, more accurate comparisons of genetic merit across flocks.

Individual flocks varied in the rates of genetic gain they achieved. Amer (2009) found no consistent effects of flock structure or design of their breeding programme. However, flocks with low rates of gain tended to repeatedly use older sires of lower genetic merit while those making the high rates of gain made greater use of superior rams from other flocks.

## Looking ahead

Sheep production faces challenges from competing livestock industries and from changing consumer demands. New traits are likely to dominate future genetic selection, including meat eating quality and production efficiency. Certainly there will be a need to review existing economic selection indexes in terms of their component traits and the economic models used to optimize them.

An investigation is under way to determine the impact of selection using SIL indexes on greenhouse gas production per unit of product produced from the New Zealand sheep industry. There are plans to review breeding objectives and make available to breeders new indexes that allow balanced selection for a combination of farm profitability and reduced greenhouse gas emissions.

Some new traits will be amenable to the current BLUP based genetic evaluation method but others are likely to receive more attention through new genetic technologies based on SNPs due to the cost, difficulty or delays in obtaining accurate BVs based on performance information. SIL is already storing and using the results of some DNA tests.

SIL and its collaborators have committed to using a common language for describing genetic merit whether based on SIL (estimated) eBV, SNP based (molecular) mBV or a combination of the two. Selection indexes use common scales and terminology. Molecular BVs (mBV) based on a 50k SNP chip marketed by Pfizer Animal Genetics, are being loaded into the SIL database and blended with SIL eBV to produce (genomic) gBV.

## Defining genetic merit

Perhaps the most interesting task facing animal breeding is what to do with the expanding variety of traits for which genetic merit can be estimated. Such has been the success of existing genetic technology, at least for some users, that they have achieved their target levels for some productivity traits and now want to focus on change in others *e.g.* some NZ sheep breeders want to hold reproductive rate and fatness at levels they currently have for their dual purpose sheep.

As a consequence, standard SIL selection indexes no longer suit all users. To address this SIL has developed a tool, ***eSearch***, to search the wealth of information contained in its large SIL-ACE genetic evaluation to find animals with defined ranges of genetic merit for particular traits. This tool is described at this congress by Young *et al.* (2010).

Having a common genetic evaluation across flocks and breeds provides the opportunity to use a common scale of genetic merit to define genotypes best tailored to different production systems. This means that BVs increasing in magnitude is not the end goal for some traits. Rather, for key traits it may be defining “positions” on a scale of genetic performance to suit particular production systems. Such an approach makes a feature of genotype diversity. As yet, no genotypes have been defined or marketed in this way.

### **Reasons for SIL’s success**

SIL has built a strong position in the New Zealand sheep breeding industry partly due to the focus put on education to suit user needs and to working with other groups to deliver technical innovations to facilitate industry buy-in and adoption of the SIL system. A highly flexible system has been critical to this success. SIL provides an easily customizable reporting system and any data can be recorded e.g. some breeders stored data on the SIL database for several years before genetic evaluations were offered for associated traits.

SIL allows those less familiar with performance recording to work with the data they collect and customize reports to suit their knowledge and objectives. By contrast experienced breeders can use the system to work with other flocks, add a wide variety of traits to suit their objectives and export SIL data to 3<sup>rd</sup> party service providers for advanced services such as optimization of mate allocation.

This flexibility and the profile SIL has in the New Zealand industry place it in a good position to keep pace with developments of genetic technology and adapt to the needs of New Zealand farmers.

### **More information about SIL**

Details about SIL and developments described in this paper can be found at [www.sil.co.nz](http://www.sil.co.nz).

### **References**

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