UTILISING THE SHEEP IMPROVEMENT LIMITED (NEW ZEALAND) NATIONAL PERFORMANCE RECORDING SYSTEM

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INTRODUCTION
Sheep Improvement Limited (SIL) is the new national scheme for performance recording and genetic analysis of sheep data in New Zealand. The SIL System evolved from several existing sheep performance recording schemes and introduced state-of-the-art software and hardware configurations as standard features. It is based around a National Database, which stores information, and a powerful Genetic Engine to perform analyses, together with commercial bureaus offering the SIL System to breeder clients (Newman et al., 2002). SIL “wholesales” the database and genetic engine to commercial bureaus and they add value and “retail” this to their clients, the sheep breeders.

SIL is also focussed on end-users of improved genestock, commercial sheep farmers. Through the setting up of a network of advisers, SIL will help breeders make the best use of the SIL System to suit their breeding objectives and will help commercial farmers to make best use of SIL information to select stock suitable to their farm environment and production systems.

COMPONENTS OF THE SYSTEM

Breeders. Genetic gains start on the farm. Experienced breeders throughout New Zealand know the value of performance recording and genetic analysis. Performance recording with recognised schemes is mandatory for some breed societies. Individual breeders and collaborative breeding groups in New Zealand have made significant progress through use of the latest technology for many years (Rae, 1977; Garrick et al., 2000). By international standards flock sizes are large, and collaborative breeding groups have very large datasets for analysis (Newman et al., 2002).

Bureaus. These commercial companies retail the SIL System as a service to their clients, the sheep breeders. Experienced staff enter data onto the Database via the internet and request reports based on breeding values derived from genetic analyses. Where such analyses have not been performed, the Database automatically requests the Genetic Engine to perform the analysis required. Data requested for reports is automatically sent out via electronic mail.

National Database. This is a large database, accessed via the internet. Data are entered onto the Database after extensive checks have been performed. The aim is to maximise accuracy of the Database. The Database stores performance data collected on farm (e.g. parent and offspring identification, weaning weights, fleece weight, ultrasound scan tissue depths), derived data (e.g. number of lambs born, survival to weaning) and breeding values resulting from genetic analyses. The Database is maintained and developed by SIL.
**Genetic Engine.** Genetic analyses are automatically performed upon request under a batch queuing system. The Database generates a request for an analysis and downloads relevant data to the Genetic Engine. Upon completion of the analysis, results (which include breeding values) are uploaded to the Database and reports automatically sent out to the user. The Genetic Engine is maintained and developed by SIL.

**Advisory service.** SIL has a network of advisers in New Zealand. These advisers help breeders make best use of SIL reports produced by their bureau. As well, advisers work with commercial sheep farmers to increase their knowledge of the SIL System which will increase the demand for improved genestock based on genetic evaluation of performance data.

**FEATURES OF THE SYSTEM**

**Unique animal identification.** All animals are uniquely identified on the basis of year of birth, birth flock and individual ID within year and flock. Provision is made for identification to change in an animals lifetime e.g. when animals are retagged or sold. The identification system means across-flock analyses are readily undertaken.

**Flexible data inputs.** Most bureaus accept data input by a variety of means including ; actual lambing books or copies of these, manually filled in pre-lists, electronic data files (sent on disk or submitted by electronic mail) and paper roll outputs from weigh scales. Experienced staff work with breeders to rapidly resolve minor data problems. Some bureaus offer sophisticated systems for electronic data capture in the paddock based on “bombproof” data loggers.

**Calculation of breeding values.** Breeding values are calculated for a range of traits, including selection criteria, goal traits and significant correlated traits. Analyses are performed across year with an animal model fitted so that information is used from all known relatives. Across flock analyses are readily implemented.

**Novel system of selection indexes.** SIL uses a ‘simple’ system to summarise the wealth of genetic information derived. Six Goal Trait Groups have been defined which combine key breeding values in an economically optimal manner to summarise genetic merit for Growth, Meat, Wool, Reproduction, Survival and Disease (Amer, 2000). These all have units of cents per ewe lambing so that relative genetic merit in one Goal Trait Group can be directly compared to another. This makes it easier for commercial ram buyers to evaluate the records of animals for sale. The Goal Traits have a clear link to farm profitability. Goal Trait Group sub-indexes are combined into an overall index of economic merit.

Standard overall indexes have been developed for dual-purpose, terminal sire and fine-wool sheep in New Zealand conditions. Economic weightings in these indexes, and the Goal Trait Group sub-indexes, take account of typical flock and industry structures, levels of production, timing and frequency of expression (discounted expressions), and projected costs and returns.

Table 1 lists the breeding values used within each Goal Trait Group. These are predicted using a subset of a large number of possible predictor traits. Not all Goal Trait Groups need be selected. In practice, Dual-purpose indexes usually include Growth, Wool, Reproduction, Survival and, most often, Meat. Disease is a special case. At present, this Goal Trait Group is solely focussed on intestinal parasites, and is linked directly with a commercial service for
evaluating faecal egg counts and blood ELISA tests for associated antibodies (McEwan, 1994). SIL will introduce Disease sub-indexes focussed on facial eczema resistance in the future.

**Table 1. Breeding values used in the Goal Trait Groups for the standard SIL indexes.**

<table>
<thead>
<tr>
<th>Goal Trait Group</th>
<th>Dual-purpose overall (DPO)</th>
<th>Terminal sire overall (TSO)</th>
<th>Fine wool overall (FWO)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Growth</strong></td>
<td>Weaning weight</td>
<td>Carcass weight</td>
<td>Weaning weight</td>
</tr>
<tr>
<td></td>
<td>Weanings weight</td>
<td>Carcass weight</td>
<td>Weaning weight</td>
</tr>
<tr>
<td></td>
<td>Ewe adult weight</td>
<td>Carcass weight</td>
<td>Ewe adult weight</td>
</tr>
<tr>
<td><strong>Meat</strong></td>
<td>Carcass lean weight</td>
<td>Carcass lean weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carcass fat weight</td>
<td>Carcass fat weight</td>
<td></td>
</tr>
<tr>
<td><strong>Wool</strong></td>
<td>Lamb fleece weight</td>
<td>12mo fleece weight</td>
<td>12mo fleece weight</td>
</tr>
<tr>
<td></td>
<td>12mo fleece weight</td>
<td>Adult fleece weight</td>
<td>Adult fleece weight</td>
</tr>
<tr>
<td></td>
<td>Adult fleece weight</td>
<td>Adult fleece weight</td>
<td>Fibre diameter</td>
</tr>
<tr>
<td><strong>Reproduction</strong></td>
<td>Number of lambs born</td>
<td>Proportion of lambs surviving</td>
<td>Number of lambs born</td>
</tr>
<tr>
<td><strong>Survival</strong></td>
<td>Proportion of lambs surviving</td>
<td>Proportion of lambs surviving</td>
<td>Proportion of lambs surviving</td>
</tr>
<tr>
<td><strong>Disease</strong></td>
<td>Faecal egg counts (summer)</td>
<td>Faecal egg counts (summer)</td>
<td>Faecal egg counts (summer)</td>
</tr>
<tr>
<td></td>
<td>Faecal egg counts (autumn)</td>
<td>Faecal egg counts (autumn)</td>
<td>Faecal egg counts (autumn)</td>
</tr>
<tr>
<td></td>
<td>Adult faecal egg counts</td>
<td>Adult faecal egg counts</td>
<td>Adult faecal egg counts</td>
</tr>
</tbody>
</table>

There is provision to develop indexes customised for a particular farming situation. SIL recommends that users wanting this should seek professional advice in order to assess likely responses in a variety of traits from such an index.

**Flexible reporting options.** Once data are on the database and have passed a variety of validation checks, bureau staff request data from which they can produce reports for their breeder clients. The SIL interface offers a powerful report writer option which bureaus use to develop standard and customised reports for breeders. The flexibility and speed of the SIL System (see Newman et al., 2002) means some breeders are requesting updated breeding values whenever significant amounts of data are added to the Database.

**Assessments of progress.** Across-year BLUP analyses allow genetic progress to be examined. SIL produces Genetic Trend Graphs for selected traits or indexes (e.g. see figure 1). These are used to monitor progress and to market a breeding programme to ram-buying clients.

**Customised service.** Bureaus and SIL advisers work together to provide a customer-focused service to breeders. As the SIL System develops and as new breeder clients join, advisers will work to ensure that all users have the means to make the most out of it for their own breeding programme. In addition, advisers are charged with working to raise the awareness of commercial farmers to the benefits that genetically improved livestock can offer.
SUMMARY
The SIL System is fast, flexible and feature-filled. It is designed to develop to suit the changing needs of the sheep industry in New Zealand. A novel method for summarising breeding values has been developed. “Goal Trait Groups” are sub-indexes of an overall economic index that focus on six aspects of production. These are Growth, Meat, Wool, Reproduction, Survival and Disease. Breeders choose the combination of goal trait groups that best suits their farming system. Progress in a breeding programme is summarised in Genetic Trend Graphs.

ACKNOWLEDGEMENTS
We thank all colleagues who helped set up and develop the SIL System. In particular, Dr Ken Geenty, John McEwan, Dr Peter Amer, Dr Neil Clarke, Professor Dorian Garrick, John Davys and Neville Amyes made important contributions. Meat New Zealand and the New Zealand Wool Board provide funding for SIL.

REFERENCES