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Sheep industry vision and SIL

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ABSTRACT

Declining global commodity price trends for meat and wool emphasize the need for greater genetic and production improvement across the sheep industry. In response to this, Sheep Improvement Limited (SIL), a joint-venture company between the Meat and Wool Boards, was set up to develop a national database and sheep genetic improvement system incorporating the three previously existing schemes, FlockLinc, Studfax and Animalplan. The SIL system began commercial operation late in 1999 and works on the basis of a wholesaler (SIL) – retailer (SIL bureaus) – customer (ram breeders and their clients) chain. Sheep production performance information flows into the database, is processed by a state-of-the-art genetic engine, and genetic improvement information goes back out to ram breeders and their clients, all via the internet. Studies have shown that some progressive breeders and breeder groups are already making up to two percent genetic improvement per year for lamb and wool traits. This adds up to a cumulative annual improvement in income in a 2,000 ewe commercial flock of about \$2,450. Uptake of this rate of genetic improvement by 50% of commercial sheep farmers would result in around \$20.8m greater national annual income from sheep.

Keywords: Genetic improvement; lamb production; wool production; SIL.

INTRODUCTION

The need for ongoing improved productivity across our national sheep flock was recognized in a joint vision shared between the Meat and Wool Boards, AgResearch, and Massey University during 1996-1997. This vision included –

- Development of an information technology strategy to give the NZ sheep industry an international competitive edge
- Establishment of a national database of individual sheep accessible via the internet and through a variety of commercial and scientific applications
- Use of the above database as a vehicle for transfer of research technology to the industry and provision of extensive breeding data for further research.

The operating arms of the two producer boards, *WoolPro* and Meat New Zealand, gave this vision strong support and pledged industry research and development funding for development of a combined national database and genetic improvement scheme. To achieve this, the two boards formed a joint venture company, Sheep Improvement Limited (SIL).

An early outcome for SIL was facilitation of a combined approach to develop the new national scheme through signing of a heads of agreement in August 1997 between the three existing schemes (FlockLinc, Animalplan and Studfax) and their parent organisations (AgResearch, Massey University and Lincoln University). Following this a project team of 15 geneticists, software developers and information technologists from the cooperating organisations, were contracted by SIL to complete development of a new database structure and genetic engine.

While the driving force for the new SIL system was genetic improvement for increased productivity from sheep, other in-built dimensions included use of new and developing production technologies, product differentiation,

traceability and quality assurance.

THE IMPERATIVE FOR IMPROVED SHEEP PRODUCTIVITY

With meat and wool price declines in the medium to long term of between one and three percent a year (Figure 1), as with other competing commodities, there is a real need for productivity increases to maintain and/or improve profitability from sheep. It is estimated that around three percent annual improvement in productivity is needed for continuing viability of sheep farms based on genetic improvement which is long term and cumulative. This improved productivity on a per animal basis is long term, while in the shorter term, other technologies, as well as stocking rates and enterprise mixes will need to be fine tuned for significant per hectare production and income improvement.

Illustrations of such genetic improvement over 30-35 years in the dairy and cotton industries are given in Figure 2, where per cow milkfat production has improved at about two percent a year and cotton yield per hectare has improved at some two and a half percent a year. This production improvement across the dairy industry has been made possible by genetic improvement, aided by widespread use of artificial breeding, and strong advisory support for use of appropriate technologies to ensure improved production potential is realized. Similarly, in the cotton industry, the consistent production improvement has been achieved through effective plant breeding and use of new and improved agronomic technologies.

In contrast to the above dairy and cotton industry examples are the trends in wool and lamb production over a thirty-five-year period (Figure 2) while on an industry-wide basis there has been little or no improvement. This indicates there has not been widespread genetic improvement for sheep production. The likely explanation for this lack of consistent progress is that there is not a suitable breeding infrastructure in the sheep industry

Fig. 1: Long-term trends in commodity prices for the sheep, beef, dairy and cotton industries showing between one and three percent average annual declines in prices.

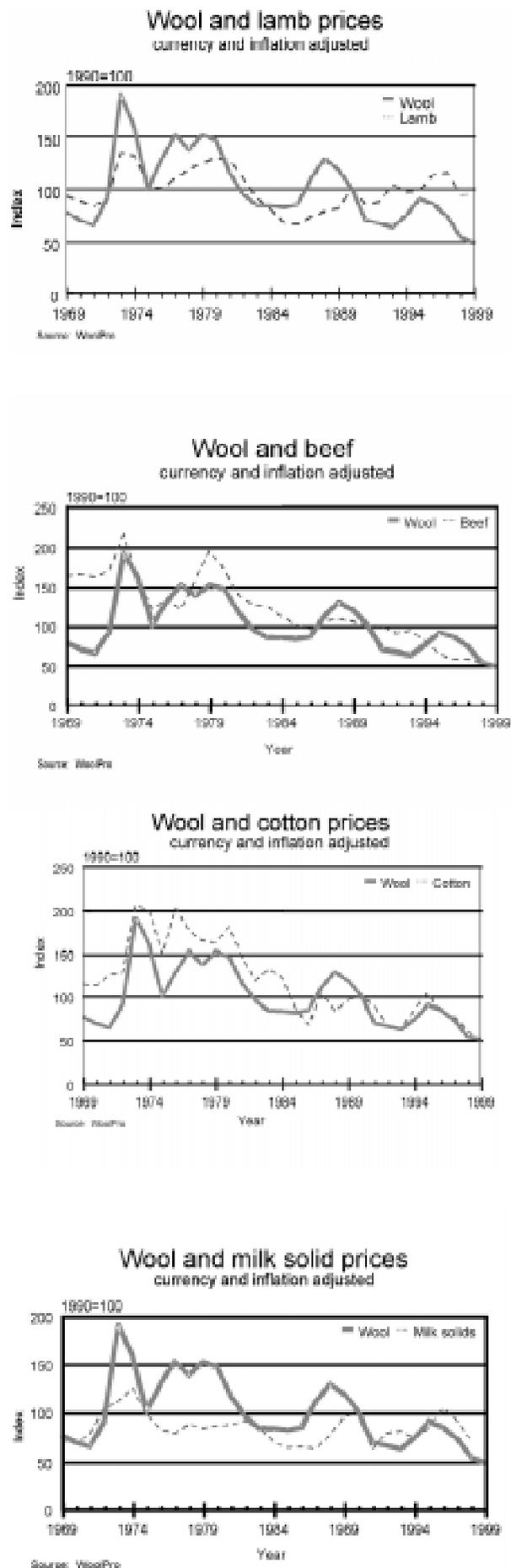
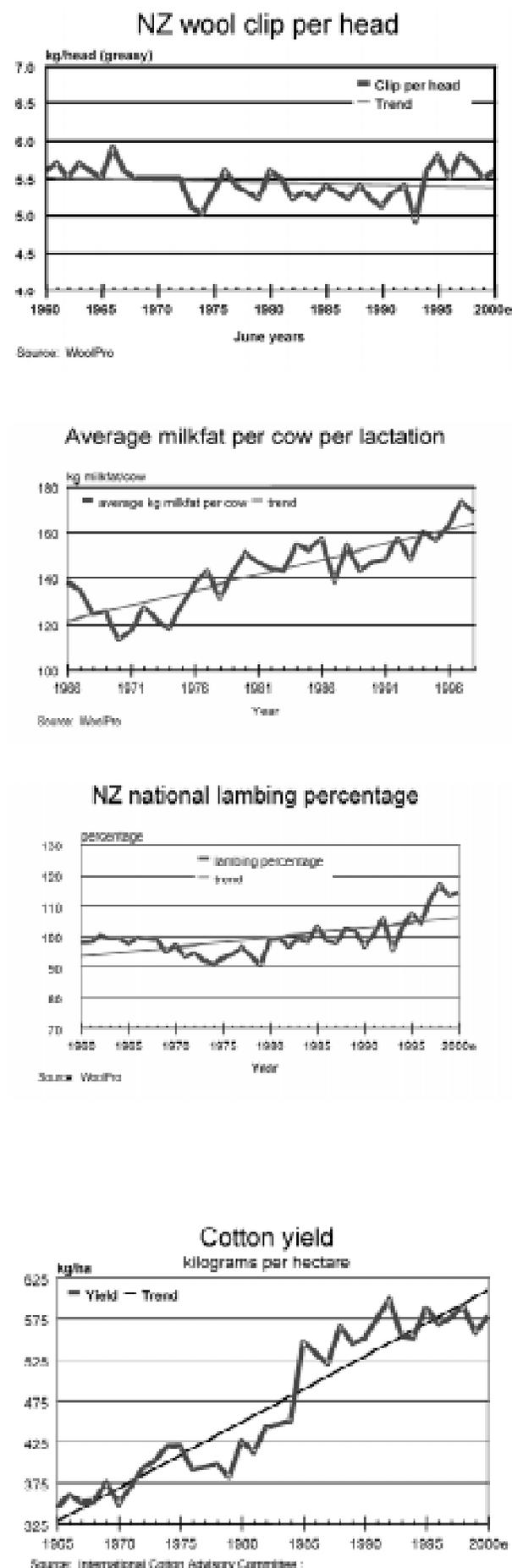


Fig. 2: Long-term production trends in the sheep, dairy and cotton industries showing little or no improvement for sheep products and more than two percent average annual production improvement for dairy and cotton.



whereby superior genes from progressive breeders and breeder groups can be effectively distributed more widely across the industry.

It could be argued the above production comparison between the dairy and sheep industries is flawed because there are barriers to effective genetic improvement across the sheep industry, including more environmental variation, a more diverse mix of products and lack of viability of widespread artificial breeding. Despite this, it is contended that the sheep industry can go some way towards emulating the above dairy industry example through use of a more effective genetic improvement scheme, embracing the whole industry, as is available through SIL, and using other available production technologies (Geenty, 1999).

THE SIL SYSTEM

Structure of the SIL system is shown in Figure 3.

The SIL system currently services some 300 ram breeders, which will increase up to around 750 in three years, through seven SIL Bureaus in a wholesaler (SIL), retailer (Bureaus), customer (breeders and their ram buyer clients) chain. This structure was chosen so that the bureaus, which also existed with their previous schemes and are geographically well spread, retained their client base and good customer relations. Breeders send their performance recorded data to their particular bureau, by hard copy or electronically, and it is then uploaded via the internet to the SIL database. Then breeders and/or their bureau request flock reports through the SIL front-end screens on the Internet. This triggers an appropriate data extract from the database which is sent to the genetic engine for processing with breeding values going back into the database and out to breeders. It should be noted that breeders can access the system directly via the Internet if they have a suitable browser, but they still need to be registered with an SIL bureau.

The 'wholesale' annual charge by SIL to bureaus is \$30 per flock and 40 cents per lamb processed while the bureaus add their particular service charge giving an overall cost to breeders of between \$1.50 and \$2.20 per ewe recorded each year. These wholesale charges are based on break-even budgeting with regard to true operating costs of SIL.

Components of the SIL system are outlined as follows – SIL

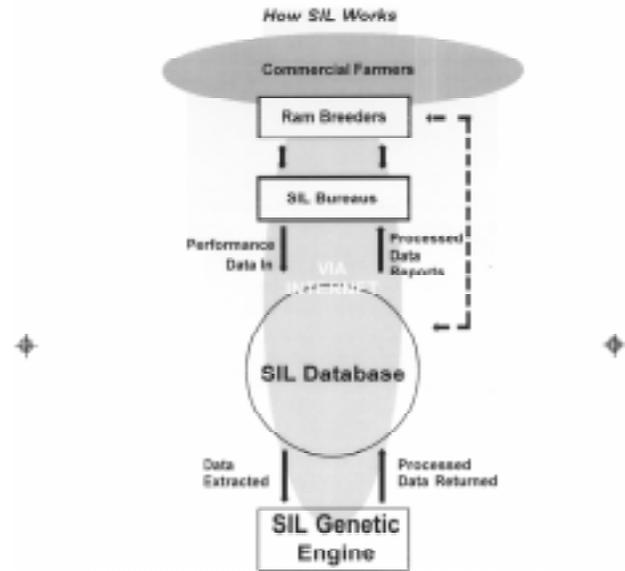
The company has a board of directors, representing the two shareholder boards with one independent breeder director. Staff of SIL include a General Manager, Operations Manager, a Database Administrator and Board Secretary. Maintenance and running of the SIL database and genetic engine is under contract to AgResearch. Ongoing research and development is from the respective shareholder boards contestable research and development funds.

Breeders

There are currently 600-700 breeders (with 250,000 to 300,000 ewes) performance recording in New Zealand and it is the objective of SIL to have all of these breeders in its database within three years. Approximately 100 of the above breeders belong to sire reference or breeder groups and it is estimated that around 75% of the sheep recorded

are dual-purpose (predominantly Romney, Coopworth and Perendale and including various crosses mainly with Finns and East Friesians).

Fig. 3: The SIL system showing the object-oriented Jade database and linkages with the genetic engine and SIL Bureaus/Ram Breeders via the Internet. Part of the database is front end screens for access into the system via the SIL website (www.sheepimprovement.co.nz) and report writers for delivery of genetic information. Ram breeders can access their flock information in the system directly if they have a web browser and SIL access codes from their bureau.



SIL Bureaus

These are independent businesses that act as a conduit between SIL and breeders. The bureaus have varying levels of help desk and backup for breeders while most sire-reference and breeder groups have independent geneticists or animal breeding consultants. Communication between the bureaus and SIL is mostly via the Operations Manager.

Currently there are six licensed SIL bureaus including Breedpac (Invercargill), FlockLinc (Lincoln), Geneplan (Timaru), NZ Performance Recording Ltd (Christchurch), NZ Romney Breeder's Association (Feilding) and NZ Sheepbreeder's Association (Christchurch).

SIL database

The database uses a modern object-oriented structure in a New Zealand-developed Jade environment. With some 25 years of back data, including information on around five million animals, it is the largest database of its type in the world.

Within this database is a strong breeding infrastructure with many linkages across flocks allowing direct comparisons of genetic merit, particularly within, and in some cases between, existing sire-reference groups. Because the three previously separate databases (i.e. FlockLinc, Animalplan and Studfax) have been joined together this 'connectedness' between flocks is stronger and more widespread than previously.

SIL genetic engine

The genetic engine has the ability to process up to 70 production traits, though most breeders record only four or

five, e.g., number of lambs born, weaning weight, autumn live weight, hogget fleece weight. Most of the other optional traits relate to meat and wool qualitative measures and disease measures.

Processing of the data routinely uses best linear unbiased prediction (BLUP), along with sophisticated statistical packages and genetic parameters derived from the large breeding database referred to above. Breeding values of economic significance are calculated for ram breeders based on six goal trait groups including reproduction (number of lambs born), lamb survival, growth, meat, wool and disease. Each group has correlated predictor traits which are used to help calculate the economically significant goal traits.

In addition, the SIL genetic engine has the ability to derive indexes, which means breeders can choose a combination of traits, with selective economic weightings (relative economic values or REV's) within either of the above six goal trait groups or any combination of them.

DEVELOPING TECHNOLOGIES

A technology development agreement with AgResearch will allow SIL to provide ram breeders with new technologies including disease resistance breeding values (e.g. facial eczema and worm resistance) and new DNA techniques such as marker-assisted selection, parentage verification and traceability. These technologies can flow through to breeders via SIL and their bureaus while the breeders may obtain associated technical backup or consultancy directly from AgResearch. Similarly, a technology development agreement under negotiation with the Wool Research Organization of New Zealand (WRONZ) will allow breeders the opportunity to develop specialized wool breeding objectives.

Some of these above developing technologies could be the forerunners of further biotechnology developments in our sheep industry using SIL as the vehicle.

RATES OF GENETIC IMPROVEMENT

Studies of performance-recorded flocks with dual-purpose sheep have shown that two percent annual genetic improvement is achievable. Some progressive breeders and breeder groups are already making genetic improvement of this order, but it is estimated that this only accounts for around five percent of breeders and seven percent of commercial farmers.

Following is an example of increased income from two percent annual genetic improvement, for a flock of 2,000 breeding ewes with a lambing of 108%, so producing 2160 lambs, of which 1500 are drafted at \$35 and clipping 5 kg wool per ewe @ \$3/kg greasy.

At 2% genetic improvement per year:

	\$
lamb liveweight improvement = 0.6 kg/lamb = 0.3 kg carcass @ \$1.80	810
number of lambs born improvement = 0.02/ewe = 40 lambs @ \$35	1400
wool improvement 0.04 kg/ewe = 80 kg @ \$3	240
Total	\$2,450

These estimates mean that individual farms that begin to make this rate of genetic progress, after an uptake period of say three years, will benefit by \$2,450 in the first year,

\$4,900 in the second, \$7,350 in the third and so on accumulating to a total of some \$68,000 after 10 years. These estimates of cumulative annual income benefits are averaged for the compounding effect of genetic improvement over each sheep generation of about three years.

The estimate here of a total cumulative benefit of \$68,000 after ten years is somewhat conservative compared with the similarly estimated \$97,755 of Davison (2000)

Projecting this annual income improvement to the whole sheep industry of 17,000 farms, with different proportions of farms having 2% genetic improvement, the following outcome is predicted:

Proportion of uptake	Additional national annual income (\$m)
10%	4.2
15%	6.2
30%	12.5
50%	20.8
75%	31.2
100%	41.6

Projected uptake by SIL for commercial farmers is ten percent within five years (\$4.2m) and fifty percent within ten years (\$20.8m).

The uptake of genetic improvement will depend on transfer of superior genes from influential ram breeding flocks to commercial flocks. Recent studies have shown that 60 influential ram breeding flocks of the Romney, Coopworth and Perendale breeds and comprising 52,000 ewes supply 22% of Romney rams, 27% of Coopworth rams and 7% of Perendale rams.

CONCLUSIONS

The SIL system has been built by a skilled professional team with joint cooperation and expertise from the previously existing schemes and funded from sheep farmers' income levies. This has provided a modern, state-of-the-art SIL genetic improvement scheme further strengthened by technology development agreements with major research providers including AgResearch and WRONZ.

SIL provides a powerful tool for both ram breeders and commercial sheep farmers alike to achieve significant genetic improvement and continuing better profits from sheep farming. Success of the new SIL system depends on widespread use and support by sheep farmers.

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