Further development of sheep recording in New Zealand

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ABSTRACT

The New Zealand sheep industry has been supported by a national sheep recording scheme, Sheeplan, for nearly 20 years. Sheeplan is directed towards genetic improvement of the national sheep flock. Its personnel have recently prepared a plan for future development which aims to extend the scope of the scheme, the accuracy of selection decisions made and the flexibility and efficiency of the recording service.

It is proposed that the improved scheme be developed under Sheeplan's existing organisation as a centralised recording scheme and that restructuring of the data storage and data processing system be undertaken to enable Sheeplan to develop in the following specific areas:
improved adjustments for non-genetic factors; greater breeding value accuracy; development of across-flock relationships among animals; extension of the Sheeplan database; establishmnent of an industry-wide database; improved operational efficiency; accommodation of electronic developments for data collection and transmission; provision of opportunities for data analysis; and improved documentation of the scheme.

The estimated financial benefit of implementing the plan is a doubling of the annual return to the sheep industry, from $9.6 million from the current Sheeplan to $19.7 million. This is achieved throught a 40% increase in accuracy of selection decisions; a 10% increase in Sheeplan membership; and a 30% increase in effective use of Sheeplan records.
Keywords Sheeplan; organisation; computer system; documentation

INTRODUCTION

The major objective of a national flock recording scheme must be to improve the productivity of the country's sheep population through raising the genetic merit of its breeding stock. Sheeplan, New Zealand's national flock recording scheme, is so directed.

Sheeplan is a dynamic scheme having undergone many modifications, ranging from major restructuring to minor enhancements, since its inception in 1967 when it was known as NFRS (National Flock Recording Service). These developments have been described (Rae, 1976; Clarke and Rae, 1977; Johnson *et al*, 1980; Callow and Johnson, 1982).

More recently a major review of Sheeplan (STG Subcommittee, 1985) has been undertaken by the authors and a long term planning proposal prepared. The findings of this review are the subject of this paper.

Sheeplan is an integral part of a total breeding package which includes the ram breeder, the ram buyer, the adviser, breed organisations, a central data control office and administrative executive, computer analysts, data files, research and development facilities and resources, and an industry-wide policy making organisation. The development plan takes cognisance of the needs of the total breeding package since the ability to realise genetic gain in economically important traits is dependent on the successful integration of the whole and not on any one component alone.

The 'improved Sheeplan' provides more accurate selection aids (breeding values), has greater flexibility and acceptability through providing more options and catering for more diverse groups and facilitates greater understanding and application of genetic improvement principles.

The improved Sheeplan package has 3 major components: organisational structure, computer system, and documentation.

ORGANISATIONAL STRUCTURE

The present balance of interests and involvements is seen by most users to be impartial and divorced from undue sectional pressures. The credibility of the scheme is fostered by the national support given through MAF to its establishment, field promotion and servicing, and continued on-going development as industry circumstances change and user requirements evolve accordingly.

The plan therefore recommends that Sheeplan continues to develop under its existing organisational structure as a centralised recording scheme but with some modifications to ensure a better integration of the people and organisations involved in Sheeplan and a better specification and allocation of resources.

COMPUTER SYSTEM

The development plan emphasises that a major restructuring of Sheeplan's data storage and processing computer system is necessary. This is seen as a basic requirement for so many of the improvements that it becomes the logical first step in the developmenbt programme. This fundamental change, while allowing incorporation of recent technological developments, does not require any major change to the genetic principles of the scheme nor in the way in which breeding value information is used by the breeder.

The restructured computer system has impact in several areas:

Greater Accuracy of Selection

Greater accuracy of selection is achieved through improved adjustment for non-genetic factors and through greater accuracy of predicting breeding values using Best Linear Unbiased Prediction (BLUP) techniques now feasible on modern high-speed computers.

Management groups are included in the range of non-genetic effects for which adjustments can be made, while the accuracy of all adjustments will be improved by the use of within-flock correction factors for the effects of birth-rearing rank, age of dam, age of lamb, sex and management group.

BLUP techniques will incorporate lifetime lamb production of the dam, instead of number of lambs born, as the measure of reproductive performance in the rankings of young animals on the selection lists. They will take account of the effects of previous culling on the prediction of breeding values from selected data and of biases from the genetic gains accurring in the flock.

Maternal effects known to influence lamb growth and carcass composition, especially in meat-sire breeds will be accounted for, and information from all available relatives will be combined through the use of pedigree relationships in estimation of breeding values.

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Development of Across-flock Relationships

The relationships between animals located in different flocks can be used to give a wider basis for breeding value prediction such as sire referencing, BLUP being the appropriate method. Breeding groups which have requirements to monitor animals of different status, e.g. nucleur-born ewe, transferred ewe, will be accommodated.

The common elements of performance and pedigree recording can be fully exploited and both the needs of the breeder and his breed society met to their mutual advantage. The requirements of breed societies have a high profile in many facets of the new package.

Extension of the Database

The data base is to be extended to cope with increasing market-led diversification in the sheep industry and from new breeding technologies such as embryo transfer, artificial insemination and cloning. Receipt and processing of data from off-farm as well as on-farm sources will be accommodated. Requirements of other species with a similar seasonality of production and database acquisition have been considered and fibre-producing goats, in particular, are accommodated with establishment of the Goatplan package. Examination of the opportunities offered by establishment of an industry-wide database is to further investigated.

Extension of the 'on-farm' database includes fat depth and eye muscle area, fibre medullation, kemp, colour and bulk, diseases such as facial eczema and foot rot. As well as extra traits the extended database accommodates codes on breed composition, e.g. for those breeders following a cross-breeding programme.

The improved Sheeplan accepts directly information from 'off-farm' sources such as freezing companies, wool testing laboratories, serum processing laboratories, breed associations and artificial insemination centres. This facilitates inclusion of special traits such as resistance to facial eczema, fibre diameter and clean fleece weight into the breeders' objectives and also streamlines liaison with breed organisations.

Improved Operations and Data Flow

A major objective of this development is to achieve an improved flexibility, efficiency and cost-effectiveness of the recording service, in particular, by taking account of recent developments in the application of electronics. Thus, the package will improve operational flexibility through interactive data correction procedures, incorporation of back data, more flexible file formats and output options, flexible processing deadlines, as well as through electronic support of Sheeplan's administrative system.

Particular emphasis is given to accommodating developments in methods for electronic collection and transmission of data from farm to central computer files. The aim is to move from the present phase of accepting data only on handwritten lists to accepting data as well from micros through direct transmission from farms or breed society offices via telephone lines, including an ability for users to display and edit data. Commercial micro vendors are encouraged to provide appropriate software for on-farm data validation in formats which match the Sheeplan data entry system.

Opportunities for Data Analysis

Easy access to the database is provided for analyses involving several flocks and generations of animals simultaneously, as well as less complex calculations. Analyses can be undertaken, for example, to update genetic and phenotypic parameters on which Sheeplan is based, to upgrade the scheme through inclusion of new options, to provide national 'on-farm' assessments of different breeds and crosses, to evaluate alternative breeding and management strategies or to provide industry statistics.

The potential benefits from analyses of new information are well illustrated by recent research on the heritability of susceptibility to footrot. Here all present research information comes from a single Sheeplan flock whose breeder has been working in association with scientists from Wallaceville and Ruakura. Susceptibility to footrot is a trait able to be included in the improved package using the parameters derived from these analyses of Sheeplan data.

DOCUMENTATION

Comprehensive documentation of all aspects of the scheme is a key element in the successful application of Sheeplan records to breeding plans. The documentation associated with the improved package encompasses several aspects: the computer system, operational and clerical procedures, instructions for users on data entry, explanations for users of outputs, technical foundations and extension applications.

The opportunities offered by the restructuring of the computer system are exploited to provide ready access to the relevant information. Examples are: an interrogative facility on on-farm micro computers for instructions for completing Sheeplan data input; extension material available on the MAF's computer network.

This documentation ensures quality control standards are met. It improves the effectiveness of existing members' breeding programmes by fostering better understanding of the Sheeplan records and attracts more members by eliminating the apparent complexities of a comprehensive scheme.

DOLLAR VALUE OF IMPROVED SCHEME

Adoption of the improved Sheeplan package by the ram breeders, their breed associations and their commercial producer clients will improve productivity in the sheep sector.

Value of Genetic Response per Ewe

The following predicted responses are based upon the estimates of genetic and phenotypic parameters embodied in Sheeplan, and the assumption that breeders will achieve 1.5 phenotypic standard deviations of selection with a generation interval of 2.75 years.

Value of Genetic Response to Sheep Industry

The gross value of the predicted annual genetic response from the present Sheeplan system to the sheep industry is worth $9.6 million. This has been estimated from the average/ewe genetic response multiplied across the industry but discounted for Sheeplan flocks not contributing to total industry ram requirements and for selection on criteria other than those available in Sheeplan-recorded flocks (i.e. based on genetic response/ewe/year of 55 cents (from Table 1), national flock of 50 million breeding ewes, 70% of the rams used nationally bred in Sheeplan flocks, and effective usage of Sheeplan records in Sheeplan flocks of 50% (0.55 x 50,000,000 x 0.70 x 0.50 = $9,625,000).

Value of Genetic Response with Improved Sheeplan

The dollar return from introducing this improved package will come from increased breeding value accuracy, increased Sheeplan membership and increased effective use of Sheeplan records in selection. A 40% increase in accuracy of selection decisions increases genetic response to 77 cents/ewe/year; a 10% increase in Sheeplan membership increases the percentage of rams bred in Sheeplan flocks from 70% to 77%; and a 30% increase in effective use of Sheeplan records takes this from 50% to 65%.

TABLE 1 Predicted annual genetic response/ewe from selection on the dual-purpose index.

Selection objective	Predicted response (Sheeplan)	REV* (Sheeplan 1972-73)	REV* (updated 1982-83)	Value of predicted response in cents ('82-83 values)
Number of lambs	0.024 lambs/ewe	554	1773	42.5
Weaning weight	0.33 kg/lamb	24	77	25.4
Hogget fleece weight	0.075 kg/fleece	92	239	17.9
Aggregate multi-trait breeding value				55.0

*REV = relative economic value; 1982/83 REV's updated using indices of export prices (NZMWBES, 1984)

The value of the predicted genetic respnse from the improved Sheeplan is worth, in 1985 values, $19.3 million gross annually from year 3 after incorporation of the improvements (0.77 x 50,000,000 x 0.77 x0.65 = $19,269,250). This is an additional $9.7 million to the gross value of the predicted annual genetic response from the present Sheeplan system.

International Market

The package will be of a standard able to be marketed internationally. Australia is negotiating a long-term commitment to Sheeplan, with some of their ram breeders currently members on a pilot-trial basis.

CONCLUSION

A dynamic flock recording scheme is the key to meeting the challenge to turn sheep genes into profitable, exportable products, as was highlighted in the 1985 Presidential Address to this Society (Callow, 1985). An improved Sheeplan package has been formulated. Implementation of that package will equip the sheep breeding industry with its most powerful tool.

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