Computer software to increase the efficiency of the New Zealand sheep industry

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ABSTRACT

A computer software package (REVGAIN) is being developed to integrate closely with Animalplan. It assists breeders and their advisers to derive relative economic values and selection criteria to suit their breeding programme.

For farmers buying flock rams REVGAIN derives relative economic values for their individual commercial flock, and hence the sort of breeder from which to buy rams.

Using specific production levels, prices, and costs for the producers' or breeders' situation, together with the corresponding Animalplan phenotypic and genetic parameters, the software calculates relative economic values that will lead to maximum economic progress in the breeding goal. It also estimates the change in each character that will occur from a standard amount of index selection. By comparing different economic outcomes from changing product prices, physical inputs or genetic responses, users derive the policy that is most appropriate to their particular situation.

Keywords Computer software, relative economic value, selection criteria, breeding objectives.

INTRODUCTION

The steps involved in establishing a breeding program are:

1. Definition of the breeding objective.
2. Choice of the most appropriate relative economic values for each trait in the objective.
3. Choice of selection criteria to achieve the objective.
4. Accurate collection and processing of performance records to estimate breeding values and rank animals on the selection criteria.
5. Use of the breeding values for selection and mating decisions. (Ponzoni, 1988).

This paper considers points 1, 2, and 3, and inter-relationships between them.

It is important to clearly separate the breeding objective from the selection criteria. The breeding objective comprises those traits to be improved genetically. The selection criteria are the characters used in assessing the breeding value of individuals. The objective should be determined first, and on purely economic grounds. It is only then that genetic factors should be considered, and selection criteria determined. (Clarke, 1988; James,1986)

The four steps that are involved in a systematic study of breeding objectives are:

1. Specification of the production and marketing system.(Bradford and Meyer, 1986).
2. Identification of sources of income and expense in commercial flocks.
3. Determination of those biological traits which have an influence on income and expense.
4. Calculation of relative economic values based on consideration of costs and returns. (Ponzoni, 1986).

Assessing market signals which fluctuate from

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year to year, and the impact these have on a breeding programme, is a complex challenge. For breeders of dual-purpose sheep, the price relativity between wool and meat varied from 10.4(per kg wool):1(per kg lamb C.W.) in 1988 to 5.2:1 in 1989. (N.Z. Meat and Wool Boards' Economic Service 1989-90). The breeder must decide on a more stable price relativity to apply to the breeding programme to maximise likely long-term economic gains. Closely following each fluctuation in market information leads to a dissipation of effort through going in one direction for too short a time to maximise likely economic returns.

Even when a long-term objective has been chosen, complex calculations are involved in iteratively examining alternative combinations of selection criteria, and selection index weightings to derive the best solution.

A further consideration is that ram breeders need to recognise the objectives of their clients in their particular farming circumstances. A breeding programme for clients on one class of country will not be optimal for clients on another class of country.

With these considerations in mind, REVGAIN is being developed. It is a computer software tool to assist breeders and their advisers to derive the most appropriate relative economic values and selection criteria to suit their breeding programmes in relation to changing market signals and the particular part of the breeding industry to which the breeder supplies rams.

METHODS

The programme first calculates "profit equations" for each of the traits in the objective. These estimate the net profit from a unit increase in each trait, taking account of the gross increase in income, less the extra costs of production.(Atkins, 1987; Ponzoni and Newman, 1989; Rae, 1988.)

One particular extra cost of production is that of any extra feed eaten. The approach taken in this model is to estimate the extra feed eaten for a unit increase in production, express this increase as a percentage of the total intake before improvement in the trait, and to then reduce the solution to the profit equation by this percentage.(Atkins, 1987; Rae, 1988) In practice this step is performed only for increases in reproductive rate. The increases in feed intake due to increases in other production traits are considered insignificant.

The profit equation for Number of Lambs Born where:

ELB	=	1 extra lamb born
SR	=	survival rate
LS	=	Proportion of lambs shorn
$LS	=	Net wool returns per lamb shorn
LSL	=	Proportion of lambs slaughtered
$LSL	=	Net returns per lamb slaughtered
LSOLD	=	Proportion of lambs sold store
$LSOLD	=	Net returns per store lamb
COSTS	=	Average husbandry cost per lamb

is

[ELBxSR]x[LSx$LS+LSLx$LSL+LSOLDx$LSOLD-COSTS]

The solution of this equation is then reduced by the percentage increase in pasture used to feed the extra lamb as above.

Similar profit equations are constructed for the other traits in the objective. Their solutions constitute the relative economic values used to combine the breeding values into a single index for each animal.

To allow different farm situations to be explored, the program has been pre-loaded with the average stock reconciliations, product prices, and costs of production for each of the eight N.Z.Meat and Wool Boards' Economic Service Sheep and Beef Farm Survey farm classes. When the percentage of clients in any two of the farm classes is specified, REVGAIN calculates an average client data set. Alternatively, the programme user can enter all the component data to have an individual farm data set.

From the data set so specified, REVGAIN then calculates the relative economic values. The user then enters the selection criteria being used in the ram-breeding flock and REVGAIN estimates the genetic gains that are expected to occur in each trait and in the index from a standard amount of selection.

The user may then increase or decrease any one of the breeding value changes and the programme then calculates the consequential changes in the other breeding values as well as the aggregate (index) change. By an iterative process of changing one breeding value at a time, the user arrives at the best individual solution for the ram-breeding enterprise. Similarly, by exploring a range of selection criteria, the most suitable combination of selection criteria and relative economic values can easily be derived.

CONCLUSIONS

REVGAIN can be used by:

1. ***Ram breeders*** to optimise which relative economic values and selection criteria to use in their breeding programmes.

2. ***Commercial producers*** to determine which relative economic values and breeding objective are appropriate for their individual enterprise, and hence the sort of breeder from whom they should seek to buy rams.

3. ***Advisers*** to
(i) examine the impact of real or anticipated changes in market signals on various ram-breeding situations.
(ii) assist individual ram breeders to optimise their breeding programmes.
(iii) assist individual commercial producers to identify appropriate sources of rams.

4. ***Students*** to understand the interactions between market signals, breeding objectives, selection criteria, and relative economic values in ram-breeding programmes.

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