A SPREADSHEET MODEL OF A SHEEP PRODUCTION ENTERPRISE

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SUMMARY

A spreadsheet computer program which models a Merino enterprise is outlined. Most biological and economic assumptions can be varied, so that a range of alternatives can be compared. Typical uses of the program involve evaluating different age structures for a breeding flock or various proportions of wethers. It is also useful for sensitivity analysis of assumptions made for which little information is available, such as increases with feed consumption with increasing body weight or reproductive rate. By examining the changes in profitability resulting from changes in the components of production, economic weights for breeding objectives can be calculated.

INTRODUCTION

The profitability of a sheep enterprise depends on a wide range of biological and economic parameters. A change in one of these variables can have many consequences, the ultimate effects of which are not always obvious. For example, an increase in lambing percentage can lead to changes in flock structure, mortality rate, feed consumption, wool production, body weight, production costs and selection intensity. The change in gross margins resulting from such an increase can vary widely, depending on factors such as feed availability and flock structure (Woolaston and Butler 1987). When formulating an objective for a breeding programme, it is necessary to evaluate the marginal value of each component of income. As pointed out by (Ponzoni 1979), there will be no unique solution which is applicable to all flocks.

This paper describes briefly a spreadsheet program which incorporates most of the identifiable factors affecting gross margins of a sheep enterprise. It models a self-replacing Merino flock, but may be used to describe a prime lamb flock by changing the relevant assumptions. By examining changes in gross margin that occur with a change in the components of productivity, relative economic values can be calculated to develop a breeding objective. The program can also be used to examine other changes, such as the consequences of a change in flock structure, as discussed by Turner et al. (1968).

METHOD

The program calculates the relative proportions of different classes of stock for the given mortality rates and age structure of ewes, rams and wethers, and then determines the numbers based on their relative feed requirements and the total feed available. This structure is also affected by the lambing rate. Ewes are categorised by their lambing and rearing status, and their production is adjusted accordingly. The wool production and sale price of wethers, weaners, surplus ewe hoggets are also adjusted for birth-rearing status and maiden dam. Six levels of adjustments are coded into the program, ranging from the most severe estimates, as might be experienced under drought conditions, through to zero handicaps. Age effects on stock prices, production levels and mortality rate are accounted for. Variable costs are calculated according to the cost of each component, the number of times performed and the number of animals involved.
Wethers can be sold as off-shears at any age. The number of ewe age groups can be varied up to nine, but at certain combinations of low lambing percentage and few age groups, the flock fails to be self-replacing, and an error results. It is assumed that the ewes are sold after being culled from the breeding flock. The number of ram age groups can also be varied. Average generations intervals and potential selection intensities are calculated for ewes, and also for rams, if the latter are assumed to be home-bred.

**Variables**

The following assumptions can be varied:

1. Farm area and carrying capacity (in units of adult wethers/ha)
2. Relative feed intakes of different classes of stock
3. Number of ram, ewe and wether age groups
4. Ram percentage
5. Lambing percentage
6. Proportion of barren, single- and twin-bearing ewes
7. Wool cuts for dry animals, hoggets and weaners
8. Clean scoured yield
9. Fibre diameter of wool from ewes, wethers and lambs
10. Net prices received for wool from ewes, wethers and lambs
11. Net prices received for sale stock at various ages
12. Fibre diameter price schedule, or micron premium
13. Age effects on mortality, lambing %, wool cut and cull-for-age value
14. Age effects on wether prices
15. Cost of rams
16. Number of routine health treatments for each class of stock
17. Costs associated with shearing, crutching, dipping, marking, mulesing, drenching, vaccinating, jetting, and transport of stock and wool
18. Effects of reproduction on wool and body weight
19. Severity of maternal handicaps on wool and body weight
20. Interest rate applicable to the livestock inventory

**Outputs**

1. Overall lambing, marking and weaning %
2. Wool production from ewes, weaners and wethers and its value
3. Number of sale animals in each class and their value
4. Total expenses
5. Gross margin
6. Valuation of livestock inventory
7. Stock numbers at shearing in each class
8. Wool cut from sheep in each class
9. Breakdown of sale stock numbers and prices
10. Breakdown of costs

Additional genetic information is also available if required:

11. Potential selection intensities in self-replacing flock, for both sexes
12. Generation intervals and potential genetic gains in a self-replacing flock
13. Increase in current flock performance resulting from selecting ewe replacements on phenotype
Limitations

1. The program is not a dynamic model, but describes a year in-year out situation, with no account taken of any carry-over effects which might occur for example, if a good year is followed by a bad year. There is provision, however, to vary the production levels and maternal handicaps as happens in practice in good and bad seasons.

2. No account is taken of the fact that feed availability varies through the year. The program assumes a total amount of feed (given by the farm size and its carrying capacity) which must be allocated according to the assumed feed intakes of the various classes of animals and their relative numbers. The sensitivity to a seasonal feed surplus can however be judged by changing the assumed feed intakes of certain classes of sheep. For example, if there is surplus of feed after lambing, the feed assigned to lambs can be reduced to almost zero.

3. There is only provision for selling animals, not buying (except rams).

4. There is no provision for examining interactions with alternative enterprises.

5. The timing of operations such as shearing is fixed. For example, it is assumed that stock are sold off-shears. This limitation can be partially overcome by adjusting wool cuts and prices for sale at

6. There is no explicit allowance made for labour. Thus the costs of operations such as marking and vaccinating should include the cost of labour.

7. Triplets and higher order multiple births are not accounted for. Modifications to the program would be necessary for the program to simulate a prime lamb-producing enterprise where such births are common.

GENERAL

The current version of the program runs under Excel, but it converts readily to Lotus. Routine analyses, such as the determination of economic weights for a breeding objective, are best performed using macros, which tend to be specific to the spreadsheet package used. Although several macros are available, users should ideally develop their own procedures so that they can be satisfied with the assumptions made. In particular, the assumptions made regarding feed availability tend to be critical to the economic values for body weight and reproduction, as shown by Atkins (1987). As there are insufficient experimental data available regarding the effect of increases in body weight and reproduction rate on pasture intake, the user is encouraged to make their own assessment regarding these assumptions, particularly as their relevance is likely to vary with the production environment.

REFERENCES


