IMPLEMENTATION AND MAINTENANCE OF SELECTION PROGRAMS FOR MEAT SHEEP

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INTRODUCTION

The implementation of a selection program requires an understanding of the production system used, the genetic structure of the breeds involved as well as the definition of breeding objectives and selection procedures to be adopted. (McGuirk, 1977). Maintenance of the program includes providing breeders with a reliable procedure for evaluating potential breeding animals, adjusting performance records for environmental effects as necessary and presenting the results in a readily understandable and usable format.

In this discussion paper the current use of selection programs for meat sheep is briefly reviewed, some existing problems identified and the possible impact of current/potential developments in the industry is considered. Because of the present involvement of meat breed sheep in existing performance recording schemes is low (Atkins, 1979) the major emphasis of the paper is directed towards an understanding of problems which need resolution so that efficient breeding programs become more widely adopted.

PRESENT SITUATION

1. The production system

Most lamb in Australia is produced by mating a terminal sire breed such as the Dorset to a crossbred dam, generally a Border Leicester-Merino (Cannon, Thatcher and Thomas, 1973). Given the availability of Merino ewes, the heterosis for reproductive characters exhibited by the Border Leicester-Merino and the predominance of the Dorset breeds this cross-breeding system should retain its popularity in the future.

2. Genetic structure of the breeds

While it is clear which are the breeds involved there have been few analyses of the genetic structure of the pure non-Merino breeds used for meat production. The structure of the Dorset Horn was examined by Fogarty (1978a, b) who observed that 90% of the flocks contained less than 201 ewes and the level of inbreeding was high; though the Dorset Horn has a hierarchical structure the apex contained relatively few flocks. A study of the Border Leicester breed by Mullaney (1974), indicated the average number of breeding ewes per flock was only 144 while less than 7% of the flocks contained more than 400 ewes. Only

1% of Border Leicester flocks had not purchased rams during the ten years prior to 1969, suggesting that the breed structure may not conform with the hierarchy observed in many breeds.

3. Breeding objectives and selection procedures

The breeding objectives in sheep meat production defined by the Animal Production Committee's 'Expert Panel on Selection of Breeding Stock for Sheep Meat Production' (Expert Panel, 1970) were stated from the viewpoint of the commercial producer. The traits considered important in the prime lamb dam were fleece weight, reproductive performance, longevity and carcase weight. High fertility, an ability to sire progeny with potential for rapid growth of lean meat and to contribute to the value of the lamb skin were desirable attributes for the prime lamb sire. The Expert Panel's (1970) selection recommendations included the use of independent culling levels although the need to develop selection procedures which combined key production records for the breeds involved in prime lamb production was recognised. Stafford and Walkley (1979) used index theory to define selection objectives for the Border Leicester and Merino breeds concluding that clean fleece weights, fibre diameter, number of lambs weaned, ewe body weight at sale and sale weight of lamb were traits which should be part of the selection objective. For the terminal sire breed it was suggested that sale weight of the progeny was the critical trait. On the basis that the assumptions required to develop indices also apply to other selection procedures Stafford and Walkley (1979) proposed that selection indices be used to choose breeding stock.

4. Performance recording schemes

At the present time both the Victoria and South Australia Departments of Agriculture operate performance recording schemes. Information is provided on adjusted weaning weight, sire summaries for weaning weight, ewe fertility records (Victoria) and options are available to incorporate body weight and wool production data (Atkins 1979). Performance data is collected 'on-farm' and body weights adjusted for age of lamb, birth/survival status and age of dam. Atkins (1979) states that an undefined number of studs carry out their own 'on-farm' adjustments of body weight. Generally however the proportion of meat breed studs participating in existing schemes is low, around 1-2% of registered studs for the numerically larger breeds. Lack of promotion is cited by Atkin's (1979) as a contributing factor for the low participation. Mullaney (1974) points out however there is marked contrast between the breeding goals recommended to the industry and the breeders perception of selection objectives.

EXISTING PROBLEMS

1. Genetic structure of the meat breeds

The implementation of a genetic improvement program depends on the existing breed structure, the genetic progress being achieved

in the influential flocks and the long term persistence of flocks within the breed.

Apart from the detailed study on the genetic structure of the Dorset Horn, a breed which is declining numerically, published by Fogarty (1978a,b) there is little or no information available on breed structure of the Poll Dorset or Border Leicester. There is a need to identify the structure of both these breeds with particular emphasis on identifying the currently, as well as potentially, important flocks including estimations of in-breeding. While the long term aim should be to maximise the participation of studs in genetic improvement programs, average flock sizes in the meat breeds are small so the possibility of implementing successful within-flock improvement schemes is limited. Information on the relative genetic merit of flocks within a breed and the current rates of genetic gain being achieved in the industry is also lacking.

2. Breeding objectives

Attempts at defining breeding objectives (Expert Panel, 1970, Stafford and Walkley, 1979) for Australian meat breeds have considered the problem by assessing the needs of the commercial prime lamb producer. Ram breeder's were advised to incorporate traits of importance at the commercial level in their selection objectives. For example Stafford and Walkley (1979) suggested that sale weight is the major selection objective for termimal sire breeds. However, a Poll Dorset breeder could contend that number of lambs reared is of importance in his objectives and also in circumstances in which the Poll Dorset is used to generate crossbred dams. Studbreeders are likely to be more receptive to adopting genetic improvement schemes if the programs developed reconcile the requirements of different sectors of the overall industry.

The Workshop on Improvement of Genetic Progress in Sheep Production (Animal Production Committee, 1974) noted the lack of definition of desirable carcase characteristics in meat production. This is still a major problem but unless the present meat marketing system changes there appears to be no justification for including carcase traits in selection objectives at this stage.

The current performance recording schemes in Australia do not allow breeders to select for "overall productivity" not has there been development work on determining the relative economic value of traits in the breeding objective. Both areas require attention.

3. Other factors impeding development of breeding programs

Estimates of genetic parameters for non Merino breeds of sheep in Australia are lacking though Gregory et al (1978) have published heritability estimates for post weaning weight and gain in Dorset and Border Leicester. A specific area identified by Stafford and Walkley (1979) was lack of phenotypic and genetic correlations for fleece, reproductive and growth traits. Both Dorset Horn and

Poll Dorset flocks have unacceptably high levels of difficult births as well as high incidences of infertility (George, 1980). There is also evidence amongst Border Leicester ewes of a higher than expected incidence of congential faults causing barrenness (Fogarty, 1974).

In the limited number of flocks invovled with the South Australian performance recording scheme difficulties encountered by studmasters have included the need to run larger management groups and the necessity to maintain records for the stud book and the performance system (J.E. Stafford, pers. comm.) Many of the large studs are involved with preparation of animals for show purposes with a proportion of the ram drop being managed separately from the flock. This management practice has implications for the development of improved breeding programs.

CURRENT AND POTENTIAL DEVELOPMENTS

The development and implementation of programs of genetic improvement for sheep consists of a series of logical steps:- definition of selection objectives, choice of selection criteria, organisation of the performance recording scheme and finally using the information as an aid to make selection decisions.

The potentially most important innovation which will occur will be expansion of existing performance recording schemes to include the use of selection indices. Features of such a system would include a choice of selection objectives and indices enabling breeders to determine which criteria they will record. Computer programs such as SELIND (Cunningham and Mahon, 1977) could be used to calculate the index coefficients which could then form part of the imput data of a performance recording scheme.

Consideration should also be given to the value of multi-stage selection particularly if a reduction in measurement costs could be achieved by selecting a proportion of rams on criteria measurable at an early age and making the more expensive measurements only on the remaining individuals.

By offering a series of indices to breeders for a given selection objective both the genetic and economic consequences of using a specific index can be evaluated. Such information would be invaluable to breeders contemplating participation in or alteration to a program. The index scores calculated for each sheep will be of value to a breeder not only for selecting his own replacements but also provide a convenient method of grading sale rams.

For the anticipated developments to occur agreement will need to be reached on the relative economic value of traits in the selection objective, though errors do not appear to seriously affect predicted genetic gains. Although the available genetic and phenotypic parameter estimates available for Australian meat breeds are far from complete Cunningham (1969) points out that if covariance estimates are poor, the basis for any other selection procedure is also undermined, so that the appropriate action will normally be to construct an index with the existing estimates.

Breed society rules for the main meat sheep breed require that pedigree records are kept. Consequently the inclusion of multiple records of reproductive performance as a selection criterion is feasible. Organising data collection so that the requirements of the breed society and the performance recording scheme are both satisfied by single set of recorded information should find ready acceptance amongst breeders.

The small flock size of many meat breed studs limits the expected genetic progress which could be achieved. Fogarty (1978a) suggest that participation in a group breeding scheme, where superior ewes are contributed to a ram breeding nucleus would effectively increase flock size and consequently allow a possible increase in the rate of genetic improvement.

New Zealand already has in 'Sheeplan' a system which incorporates many of the features I believe should be offered to breeders. As Callow (1979) states 'Breeding achievements depend not so much on the need for new knowledge as on the stimulus to put known technology into practice'. Perhaps the final report of Animal Production Committee's Working Party on Sheep Performance testing and Recording Services will provide the necessary stimulus in Australia.

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