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ORGANIZATION OF SHEEP IMPROVEMENT IN NORWAY

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SUMMARY

A National Sheep Breeding Council appointed by the Ministry of Agriculture is responsible for the sheep improvement programme at the national level. The smallest unit in the organization is the ram circle which is a breeding co-operative for progeny testing of rams. Most of the costs related to the breeding work are paid by the government. The sheep recording service, and the carcass quality and wool quality assessment services provide the main sources of information about the animals. Some attempts to simplify the recording are mentioned. Factors which may affect selection decisions and dissemination of genetic gain into flocks outside the scheme, together with some likely future developments, are discussed.

INTRODUCTION

Only about 4.5% of the total agricultural income in Norway comes from sheep products. The flocks are small, the average size in 1975 being 34 animals. The breeds are mainly of dual-purpose type, and there is little systematic crossbreeding.

The present breeding programme for sheep was formally started in 1969 and is described by Haugen *et al.* (1968) and Gjedrem (1969). The breeding goal has been clearly defined on the basis of economic traits. The programme involves close co-operation among the many small flocks, especially in the progeny testing of rams.

All recorded flocks are regarded as belonging to the breeding scheme, although the most active part is formed by those which participate in the organized progeny testing of rams.

ORGANIZATION

NATIONAL SHEEP BREEDING COUNCIL

Recognizing that an efficient breeding programme needs support from and co-operation among several groups in the community, the Ministry of Agriculture appoints a National Sheep

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Breeding Council with members from several organizations. The Council, which is re-appointed every two years, is responsible for the sheep breeding programme at the national level, and advises the Ministry in its financial support of the breeding work.

The Sheep Breeders' Association, the Meat and Wool Marketing Organization, Department of Animal Genetics and Breeding at the Agricultural University, and the Ministry's advisory section are all represented on this Council.

A full-time qualified geneticist is attached to the Council as sheep breeding adviser. Testing and selection of rams have received special attention in the overall programme, and one of the adviser's main duties is to supervise the part which involves progeny testing.

LOCAL ORGANIZATIONS

There are 15 to 20 district councils for sheep breeding, on which sheep breeders, meat and wool marketing interests, and advisers are represented.

The smallest unit in the organization is usually the ram circle. A ram circle is a group of farmers who, because of the small flocks, co-operate in the progeny testing of rams. In 1975 there were 100 such circles in the country, covering 10.7% of the sheep population.

COSTS OF THE PROGRAMME

The government subsidizes animal production in a number of ways, and financial support to breeding work is one of them. Costs specific for the programme include data processing, extra costs attached to progeny testing of rams (e.g., transport of rams), carcass-quality evaluation, wool quality assessment, and administration.

Most of these costs are paid by the government, and were for 1975 estimated at about 1.2% of the total income from the sheep industry (Sletten *et al.*, 1976).

RECORDING

There are three main sources of information about the animals, namely, the sheep recording service, and the carcass quality and wool quality assessment services.

THE SHEEP RECORDING SERVICE

The sheep recording service included 112 000 ewes in 1975 which is 15.4% of the sheep population. The aim, however, is to achieve a level of participation of at least 30%, this being considered necessary to provide most of the population with highly selected ram lambs or progeny-tested rams.

About 70% of the recorded sheep are found in the ram circles which annually progeny test 1400 to 1500 rams on the basis of an average progeny group size of 40 to 45.

Answers to questionnaires indicate that the small flocks, with limited relative economic returns from sheep, may limit participation in the recording service. The labour involved seems to deter the larger flocks. Simplification of recording procedures, if possible without reducing the value of the service too much, is therefore considered important. Thus, simplification of fleece weight recording has recently been considered. For this purpose the cost of recording was compared with the capitalized value of the resultant loss in annual gain in aggregate economic genotype.

CARCASS QUALITY EVALUATION

From each progeny group 10 ram lambs are randomly drawn for carcass quality assessment. The Meat Marketing Organization is involved in this work which is rather costly and time-consuming. Characters recorded are carcass weight, eye-muscle area, hindquarter weight, fat colour, kidney-fat weight, and a subjective score for the whole carcass.

A simplification, involving only subjective scoring of the carcasses, has been considered, but rejected. Even with an increased number of slaughtered lambs per sire (from 10 to 15), the genetic gain in eye-muscle area will be reduced by 14% by replacing objective measurements with subjective scoring (Sletten *et al.*, 1976).

WOOL QUALITY EVALUATION

Fibre diameter, medullation and staple length are measured at a central wool laboratory. This work is mainly restricted to the final selection step of ram lambs after selection on the basis of weaning weight, subjectively measured wool weight and wool quality, plus parental pedigree information, has occurred.

SELECTION

SELECTION INDEXES

The information collected is concentrated into a series of selection indexes. These indexes, and the traits and information included in them, are given in Table 1. Weaning weight and carcass traits are recorded on lambs 150 to 160 days of age.

SELECTION INTENSITIES

Some phenotypic selection differentials obtained in the ram circles were calculated by Eikje (1975) and are given in Table 2.

TABLE 1: SELECTION INDEXES USED IN THE PROGRAMME

| <i>Index</i> | <i>Traits and Information Included</i> | <i>Age when Calculated</i> |
|----------------|--|----------------------------|
| Ram lamb index | Own weaning weight, fleece quality and conformation; plus parental index information. | 6 months |
| Ram index I | Weaning weight of all lambs; carcass weight, carcass quality and fleece weight of sample progeny. | 1½ years |
| Ram index II | Ram index I plus number of lambs born, fleece weight and lamb weights measured from the daughters' production. | 3½ years |
| Hogget index | Own weaning weight, fleece weight; plus parental index information. | 16 months |
| Ewe index | Number of lambs born, fleece weight, weaning weight of lambs; plus parental index information. | Updated each year |

TABLE 2: SELECTION DIFFERENTIALS AND INTENSITIES IN THE RAM CIRCLES

| | <i>Trait or Index</i> | <i>Selection Differential in Phenotypic Standard Deviations</i> | <i>Equivalent to the Following % Best</i> |
|--------------------|-----------------------|---|---|
| Ram lambs | Adj. WWT | 1.84 | 8.3 |
| Ewe lambs | Adj. WWT | 0.40 | 76.6 |
| Rams to sire rams | Ram index I | 2.44 | 1.9 |
| Rams to sire ewes | Ram index I | 1.49 | 17.0 |
| Ewes to breed rams | Ewe index | 1.53 | 15.7 |
| Ewes to breed ewes | Ewe index | 0.70 | 56.3 |

Selection of ewe lambs for adjusted weaning weight has been rather weak, while the selection of several other categories of animals has been moderate to very strong. No figures are available for Ram index II, but the selection for this index has certainly been weak. This since the rams are too old ($3\frac{1}{2}$ years) when the daughter information becomes available, and relatively few rams are left to select among. Only about 50% of the ram lambs and 30% of the ewe lambs retained for breeding are sired by rams with a Ram index II. As a consequence of this, it is now proposed that half-sister information should be included in Ram index I when the rams are $1\frac{1}{2}$ years of age.

ORGANIZATION OF SELECTION

Several features of the breeding programme may have led to good utilization of the recorded information in selection decisions.

Extension

Perhaps the most important factor has been the continuous extension programme undertaken by advisers and scientists on the consequences and value of selection.

Co-operation

The breeding co-operatives which the ram circles represent have undoubtedly had an effect in restricting the selection decisions towards meaningful economic objectives. The interest of the majority, efficient production of meat and wool, has as a rule been put ahead of more personal interests like selling and favouring one's own animals. The ram circles buy the rams used for progeny testing and have therefore complete control over the use of proven rams.

In the ram circles a minimum of 10, and on the average 17 to 18 rams are tested each year. This gives opportunity for strong selection among progeny-tested rams when they are $1\frac{1}{2}$ years of age.

Common Breeding Goal

A clear specification of the breeding objectives has probably been of greatest advantage in its relation to standards set at sheep shows. Traditionally, conformation has been the far most important trait at the shows. Since 1970, however, the rules for the official sheep shows have ensured that production traits and selection indexes have been the main evaluation criteria. General

agreement about a common breeding goal has also increased the population from which one can select, and thus increased the possibility for intense selection.

Small Genetic Differences Among Flocks

It is found that genetic differences between flocks in the ram circles are of minor importance (Eikje, 1974). This might well be a consequence of a common breeding goal, and co-operation and exchange among flocks in the use of sires. This knowledge, that every flock has an almost equal chance of producing an outstanding ram, in effect increases the population from which selection is carried out.

Animal Classification Procedures

Ram lambs, progeny-tested rams and ewes are divided into groups according to their index. For instance, progeny-tested rams are divided into élite rams, A-rams, and rams to be slaughtered. The breeding programme contains a clear recommendation about the use of each of these groups. This grouping has been a help in the selection of ram lambs for testing by the ram circles, in the selection among proven rams, and in the planning of élite matings.

Exclusion of Repeat Progeny Tests

The rams are progeny tested on reasonably large progeny groups for the first time when they are 1½ years. This progeny test may not be repeated. Selection must therefore be based on this first test and it is not possible to use a poor or average ram in the hope that the next test will bring him up.

Organizational Control

As government money goes into the breeding work, some sort of control is desirable to ensure that the money really is used to the benefit of the sheep industry.

One of the local breeding councils' duties is to approve the selection of ram lambs for testing in the ram circles, to control the use of the selected proven rams, and to ensure that inferior progeny-tested rams are slaughtered.

The National Sheep Breeding Council can withhold economic support to circles not following certain rules in this connection, although very seldom, if ever, has this been found necessary.

DISSEMINATION OF GENETIC IMPROVEMENT

The breeding programme has resulted in a favourable rate of genetic progress for a number of traits (Eikje, 1976). However, to justify the expenditure of the programme, it is very important that the gains obtained from within the breeding group are transferred to flocks outside the scheme.

Sletten *et al.* (1976) have shown that 50% of the total sheep population is either in flocks participating in the scheme or in flocks buying selected rams directly from such flocks.

The following factors have probably been important in the dissemination process:

- (1) Extension information on the advantages of buying selected rams from recorded flocks.
- (2) Restriction of ram prices to a moderate level. It has been stressed that selling rams at extraordinarily high prices does not mean an extra income to the sheep industry as a whole. The National Sheep Breeding Council indicates approximate prices which should be taken, and paid, for the different categories of ram lambs and proven rams.
- (3) Economic support to buyers of selected rams. In certain circumstances, the government supports buyers of high-quality rams.

SOME LIKELY FUTURE DEVELOPMENTS

A recently presented study group report (Sletten *et al.*, 1976) together with other experience provide pointers to future developments within the breeding programme.

Selection of ram lambs, mainly based on own phenotype, has proved very useful. Lambs from recorded flocks are approved or not approved for breeding according to certain criteria. Today 7 ram lambs are approved annually for every 1000 ewes in the total population. Work towards a doubling of this ratio will be stimulated. In this connection an increased participation in the sheep recording service is necessary. This will be sought through a better local organization of the service, especially outside the ram circles, and better local advisory service.

In the progeny testing of rams for carcass traits and individual growth-rate, emphasis will be given to increased accuracy through increased and less variable progeny group sizes. Further, progeny testing on the basis of the daughters' productivity will, to a great

extent, be replaced by selection on the basis of the sisters' productivity.

The number of rams progeny tested each year (2 per 1000 ewes in the total population) is at present as suggested for the breeding programme.

The sheep shows have lost interest in recent years and are of little value in the present breeding programme. They should be re-designed to serve other purposes.

Endeavours to improve the selection indexes already used (Table 1) will continue. In the future a common aggregate genotype, based on all the traits in the breeding goal, will be defined. The various selection indexes will then be developed to predict this aggregate genotype regardless of whether phenotypic information about all the traits is included in the particular index or not (Gjedrem, 1972).

A large-scale programme for carefully controlled crossing with Finnish Landrace to increase fertility in Norwegian breeds of sheep has already started. Only selected offspring of superior progeny- and sister-tested crossbred rams will be available for the commercial breeder.

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