A STUDY OF THE INHERITANCE OF FOLLICLE AND FLEECE CHARACTERISTICS IN MERINOS, NEW ZEALAND ROMNEYS, AND THEIR CROSSBRED PROGENY

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ABSTRACT

A study was carried out to investigate the inheritance of follicle and fleece characteristics in Merinos, New Zealand Romneys and their crossbred progeny under North Island conditions. A total of 637 animals were sampled from the Ministry of Agriculture and Fisherie's flocks at Tokanui. It should be noted that the Romneys studied, were not the parents of the crossbred animals. Six flocks were sampled.

Least squares means of the Romneys, Superfine Merinos, Local Merinos, Superfine Merino x Romneys, Local Merino x Romneys and Backcross (3/4 Superfine Merinos) were respectively as follows: secondary to primary follicle ratio (S/P), 6.68, 18.06, 18.66, 10.92, 10.32 and 15.81; follicle density n(P+S), 35.73, 69.69, 82.07, 49.57, 45.92 and 73.60; primary follicle density (nP), 4.72, 3.70, 4.23, 4.12, 4.23 and 4.40 and mean fibre diameter (MFD) 37.26, 20.71, 22.56, 26.24, 28.23 and 21.21.

Of the fixed effects tested (age, birth/rearing rank and year of sampling) only age exerted a significant effect on most fleece and follicle characteristics. The repeatabilities for all follicle characteristics were greater than 0.4. Most objectively measured fleece characteristics also showed moderate levels of repeatability. Heritability estimates for follicle characteristics, calculated from small numbers of daughter/dam pairs, were moderate to high.

Phenotypic and genetic correlations for 21 fleece and 7 follicle parameters are reported on data corrected and uncorrected for fixed effects. An attempt was made to predict S/P using stepwise multiple regression techniques, but the resultant equations had low accuracy. There was negative heterosis in both crossbred genotypes for most follicle characteristics. LWT showed the highest level of positive heterosis.

Methods of main gene detection were used to investigate the underlying genetic factors controlling follicle inheritance. Although follicle data had skewed distributions there was little evidence for genetic segregation for n(P+S). Multifactorial inheritance of n(P+S) was indicated. Two or more loci are possibly involved in the inheritance of S/P. The S/P genes appeared to behave in a recessive fashion. In contrast, the current results suggest the presence of a main gene for primary follicle density in both types of Merino x Romney flocks.

INTRODUCTION

In animals to be farmed for the production of textile fibres it is necessary to combine maximum rates of fibre formation with the best possible value per kilogram.

Fibre fineness is very important in determining the suitability of fibres for clothing since, with garments of the same weight and shape, those made from finer fibres will have greater warmth, softness and bending flexibility.

With sheep, the combination of high fleeceweight and fine fibre diameter is only attained in sheep of high follicle density. This is best illustrated by comparing the fleece and follicle populations of the Merino and other breeds of sheep. Although the diameter and weight of each fibre produced is very low, Merino sheep rank highly in weight of wool produced because they have far more follicles than other breeds of sheep.

Carter and Clarke (1957a) showed that this high follicle density in the Merino was due to the fact that they develop far more secondary follicles and Carter (1955) developed the technique of using the S/P ratio as the criterion of secondary follicle development.

Traditionally animal breeders have utilized techniques that bring about genetic improvement, even though individual genes are not recognized. More recently, there has been increasing interest in searching for main genes, since this knowledge has potential advantages:

1. It is not too difficult to utilize crossbreeding, followed by backcrossing and selection to transfer a gene from one breed to another. In this way the poll gene from Corriedale and Ryeland sheep was transferred into Dorset Horns to establish a polled strain.

2. With modern techniques of DNA manipulation and injection into the pronucleus of embryos it may soon be possible to take a gene from one individual and transfer it into a newly developing young animal with a very different genotype, at other loci.

The identification of a high follicle density gene may thus allow the gene to be transferred by either of the above means.

The present topic was chosen because of the suspicion that follicle traits, particularly S/P ratio, might be inherited fairly simply. Merinos and Romneys are so different in these traits that it was decided to investigate the inheritance of S/P ratio in Merino x Romneys. A flock, including straightbred Merinos and various classes of crossbreds, was available on the Tokanui research farm. Although these flocks had been established some time earlier and samples had not been taken at the time of establishment of the crossbreds, they provided a reasonable, if not ideal source of data.

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