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A STUDY OF MILK PRODUCTION
AS IT AFFECTS
LAMB GROWTH IN ROMNEY and
CHEVIOT CROSSBRED SHEEP.

A Thesis
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requirements
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THE PURPOSE OF THE STUDY

The Cheviot sheep has been introduced into New Zealand to replace the New Zealand Romney on certain classes of poor or marginal hill country. Before the Cheviot can oust the Romney commercially, however, the fundamental features of its performance must be critically examined by means of experiments planned to compare the two breeds.

Owing to the shortage in New Zealand of pure Cheviot stock and because of the difficulty of importing large numbers of purebreds, the crossing of the Cheviot with the Romney has been resorted to. The New Zealand flock Romney is derived from basic Merino stock by repeated crossmating with Romneys and a distinctive type of Romney, now considered as pure, has been evolved. Similarly, the grading up of basic Romney stock by the Cheviot is now being attempted in order to increase the Cheviot numbers.

Since Romneys have certain qualities which could well be incorporated into any line of Cheviots, it is important to assess the qualities of these crosses in relation to their proportion of Cheviot blood.

To this end, certain aspects of the problem have been studied and are discussed in this thesis. The principal aims of the study were as follows :

- (1) To investigate the milking ability, both quantitatively and qualitatively, of the Romney, the three quarter and the half bred Cheviot 6 year old ewe. (See definition of terms.)
- (2) To investigate some of the quantitative and qualitative variations in ewe milk affecting lamb growth.

(3) To compare the cost-for-age threequarter and half bred Cheviot ewe as a producer of fat lamb, with comparable aged Romneys.

I N T R O D U C T I O N

The suitability of any breed of sheep for a particular environment may be measured by the departure of that breed from the standard of excellence optimum for those conditions. Therefore it is necessary to postulate initially, the environment in which the Cheviot is required to replace the Romney.

While generally this may be described as poor North Island hill country, Hewitt (1) gives a more specific description when he refers to -- "poor hard birch country - the gully faces are steep and rocky. Scrub, gorse and broom are a constant menace. The carrying capacity is about half a ewe to the acre on browntop pasture which is very hard and of a run out nature."

Under such conditions an "optimum" sheep must perform as follows :

(1) Fertility and Fecundity.

The breed must be able to reproduce normally and in order that maximum selection may be practiced, a high lambing percentage is required (Lush (2).)

(2) Thrift Inherent in ability to thrive on low levels of nutrition is the attribute of conformation which allows a sheep to climb freely and thus graze selectively from what feed exists.

Also conditioning thrift are freedom from pathogenic and metabolic disease and resistance to the rigorous climate always associated with this type of country.

(3) Conformation for Meat Production

This arbitrary quality is difficult to define,

since true measurement of this character can only be accurately made upon the carcass of the slaughtered animal.

Meat production, being a secondary function of hill sheep, resolves mainly upon the progeny of the cast-for-age ewes brought to the "lowland" for fat lamb production.

Walker and McMeekan (74) have found, however, that good and bad conformation in the cast-for-age Romney ewe produces no significant difference in the carcass quality of the respective fat lamb progeny.

Phillips and Barton (3) found that under the present system of fat lamb grading, the marked prepotence of the Southdown as a fat lamb sire necessitates only that the cast-for-age ewe be able to fatten her lamb in the shortest possible time. For this, the ewe must produce a plentiful milk supply and criteria of conformation can be neglected.

(4) Wool Production

The quantity of wool produced by sheep under the hard conditions stipulated, must be at a maximum without endangering the qualities essential for high monetary return.

(5) Related to all the above attributes of the "optimum" sheep and of vital importance itself is the manner in which the young sheep is reared.

While the growth potentialities of livestock are predetermined at conception, their expression at all stages of growth is in relation to the environmental conditions in which the animal exists.

Nutrition, not the least of the environmental

agencies, determines largely how close the hereditary potential for growth will be approached.

Hammond (4) postulates that nutritional conditions in early life limiting growth can materially affect the ultimate development of the animal.

Brody (5) attempts to analyse the effect of productive improvement as it approaches the hereditary potential of the animal for either growth, muscular work or milk production. As productivity, due to increased growth rate or milk production is improved, the question of efficiency both in physiological and economic terms becomes important. Efficiency is not a simple concept - it must be viewed from the several points of -

- (1) That pertaining to the animal
- (2) That of the farmer
- (3) That of immediate efficiency, and
- (4) That of long range efficiency.

Whether increased productivity results in greater immediate efficiency depends on the relative acceleration of the productive process on one hand, and the maintenance cost on the other. But granted an increase in immediate efficiency, how will this affect the long range efficiency, viz: health, fertility and longevity? Also while energetic efficiency, the ratio of the desired form of output energy to the given form of input energy (Brody (6)) is of importance to the farmer, monetary profit has an over-riding value.

That conversion of feed to animal products with equal energetic efficiency may not return equal profit, is explained by the fact that fixed costs per animal are less in

a small group of large animals than in a larger group of small animals. Consideration must therefore always be given to the level of production giving the optimum combination of energetic and economic efficiency.

Contrary to common belief, the most rapid growth can be associated with the highest early mortality (Dove (8)). Thus while maximum growth rate may be economical to the farmer in saving overhead maintenance costs, it may not be profitable to the animal, whose longevity may be thereby impaired.

The relatively short period of growth considered in the production of fat lambs precludes any loss of long term efficiency.

In the rearing of hill country breeding stock, however, it may be pertinent, since constitution and longevity are more vital considerations. Whatever the destination of the young sheep, however, it is of importance to investigate the food which forms the major part of their diet for the first months of life and to see if variations in its quantity and quality affect the lambs' growth.

In common with other young animals the lamb is dependant on milk for the important period bridging dependant intrauterine and independent adult life. Hammond (4 C) states that milk is of even more importance to lambs than it is to young cattle and pigs -- "a shortage of milk causes young lambs to grow more wool than meat; they become pot-bellied, unthrifty and are forced to eat larger quantities of less digestible foods with the above-mentioned results."

The importance of milk to young sheep may be deduced from a review of its functions and properties.

Colostrum, the fluid secreted immediately post-partum, is of extreme importance since its constituents provide temporary resistance to the diseases liable to affect the suckling animal. Normal milks of various species differ considerably in the content of the various nutrients but all milk has certain common characteristics. Briefly these are,

- (1) Milk is easily digested and assimilated, the nutrients being supplied in forms particularly adapted to the undeveloped systems of mammals at birth.
- (2) Milk is rich in protein supplying an ample amount of all the essential amino acids.
- (3) Milk, on a dry matter basis, is rich in some minerals, especially calcium and phosphorus, the two minerals needed in largest quantities by growing animals.
- (4) The fat and sugar in milk furnish concentrated energy in a readily assimilable form.
- (5) Milk contains usually adequate amounts of most vitamins necessary for normal body function.

Analyses of milk from various classes of livestock have shown that the composition of the milk of different species is closely related to the relative growth rate during the suckling period. While a knowledge of the composition of the milk of domesticated animals is essential, in that it indicates the quality of nourishment available for the growth of the young, it is no accurate index of the comparative rearing ability of different individuals within the same breed.

Within a species the quantitative production of milk seems to be of greater importance in the determination of the nutritional level available for the young growing animal.

When the production of fat lambs is being considered, economical production depends almost entirely upon the rate and economy of gains in total liveweight made by lambs reared.

To this end the fertility and milk producing ability of the ewes are of fundamental importance. The attainment of maximum economy either through increased rate of reproduction or by increased rate of growth is to be considered in this study.

DEFINITION OF TERMS

- Half Cheviot - The progeny of a Romney ewe crossed with a Cheviot ram.
- 3/4 Cheviot - The progeny of a $\frac{1}{2}$ Cheviot ewe crossed with a Cheviot ram.
- Milking ewes - Those ewes whose milk yields were estimated.
- Non-milking ewes - Those ewes which did not receive the milking treatment.
- Milking lambs - Progeny of milking ewes.
- Non-milking lambs - Progeny of non-milking ewes.
- Milking - Refers to the procedure whereby ewes' milk yields were estimated.
- Sampling - The manual expression of a representative milk sample from one half of a ewes udder.
- Half - Refers to a functional half of the mammary gland of the ewe.
- Lactation curve - The graphical representation of the trend of milk yield in response to the advance of lactation.
- Fat test - The fat % of a milk sample.
- Mean or average - Refers to the arithmetic mean unless otherwise stated.

SIGNS OF SIGNIFICANCE

- ** - Significance at the 1% level
- * - " " " 5% "
- N.S. - Not significant (significance at a level greater than 5%)

Male Lambs - All lambs nominated male were castrated at 3 - 4 weeks of age.

Growth rate - Unless otherwise stated refers to the average growth rate which equals $\frac{W_2 - W_1}{t_2 - t_1}$

where W_2 and W_1 are weights at times t_2 and t_1 respectively.

Growth - Unless otherwise stated refers to the increase in liveweight.