Controllable Factors which Influence Wool Returns

QUALITY in wool commands a small but worthwhile premium at present—and, indeed, at most times—but weight of fleece has a more important effect on returns. Fortunately improvement in yield is usually accompanied by an improvement in quality. Factors affecting wool returns over which farmers can exercise some control were discussed by E. A. Clarke, Senior Research Officer, Department of Agriculture Animal Research Station, Ruakura, in a paper which he delivered to the 1951 Ruakura Farmers' Conference Week and from which this article is adapted.

AN understanding of the fundamental facts about the origin and growth of the wool fibre is helpful to an appreciation of the factors influencing the development of the fleece.

Development of Skin Follicles

The follicles in the sheep's skin which produce the wool fibres are laid down early in foetal life, and by the fortieth day after conception a definite pattern of follicles has appeared. As in the growth and development of the body, the follicles develop in orderly fashion. A wave of development spreads from the head down the midline of the back to the tail and from the back toward the belly and down the limbs. By about the ninetieth day the whole body carries a clear-cut pattern of follicles, arranged in trios. These, the early-founded or primary follicles, grow the coarsest fibres, which are usually hairy, and the kemps. They comprise the coarse outer coat of primitive sheep and are present in the improved breeds, particularly in the "halo hairs" which occur on many lambs and in the face and leg hairs. These fibres fall out of the fleece during the first few weeks after the lamb is born and are replaced in the same follicles by fibres which continue to grow indefinitely and otherwise generally resemble the fibres of the remainder of the fleece, but in some sheep they may be replaced by more coarse, hairy fibres and kemps which constitute a fault in the wool by reducing its range of usefulness.

Secondary Follicles

From about the ninetieth day onward many smaller follicles are founded about the trio groups. These are the secondary follicles and produce the true wool fibres which in the primitive sheep make up the fine undercoat. In the improved sheep the secondary fibres make up the bulk of the fleece, and around each primary trio group from 30 to 100 secondary follicles develop, according to breed and type of sheep. By the time the lamb is born its follicle arrangement and population are about complete. After birth, but for only a short time, a few more secondary follicles are laid down, but for practical purposes the maximum number of fibres the sheep can grow throughout its life has been decided by then. Moreover, for all practical purposes the course of follicle development in the foetus cannot be influenced by man, so efficient is the "buffering" ability of the mother against environmental changes. Follicle development and pattern are predetermined by heredity.

Structure of Follicles

The essential features of a primary follicle are shown in Fig. 1. The secondary follicle differs from the primary follicle chiefly in the absence of the sweat gland and the arrector muscle. The diagram also shows a medulla or spongy, air-filled core in the fibre; a true wool fibre lacks the medulla and is a solid fibre enclosed in the sheathing cuticle.

The workshop of the follicle is the papilla at its base. It is a region of active tissue well supplied with fine blood vessels and nerves, and by the budding off of new cells the fibre is pushed up and through the skin. The new cells have hardened and changed to keratin (the material comprising horn, hoof, fingernail, and wool) before the surface of the skin is reached. Once this has occurred the fibre is a dead structure and cannot be changed by the animal or improved by any practicable treatment of the growing fleece. Dipping, for example, can in no way improve it, but it may be damaged by such factors as dips, stains, sunlight, and micro-organisms.

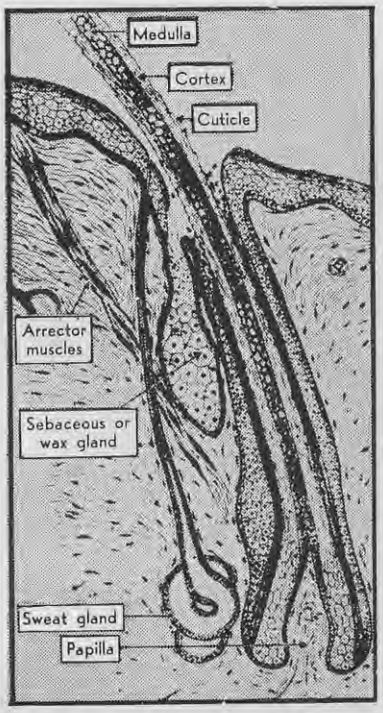

Fig. 1—Essential features of a primary wool follicle.

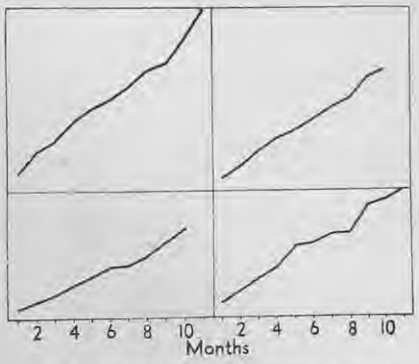

Fig. 2—Variations in the monthly wool-growth rate of four Romney ewes under conditions of unrestricted grassland feeding.

Influence of Nutrition

Many factors, however, influence the activity of the follicles and hence the amount and kind of wool produced. Apart from inherent factors, including breed, sex, and age, the greatest single factor is the level of nutrition. Maximum nutrition enables each follicle to produce the greatest possible amount of keratin and results in the coarsest and longest fibre possible. Lowered nutrition causes the output of fibre material to be reduced and results in a finer fibre, and to a less extent a shorter fibre, and also causes some follicles to cease functioning, temporarily at least, and thus to shed their fibres; this not only results in reduced fleece weight but also affects wool quality. Under extreme conditions shedding of the fleece can occur because of almost complete cessation of follicle activity.

Coarsest Fibres Least Affected

All follicles do not respond similarly to lowered nutrition. The first fibres to be affected are the later-founded secondaries, and the coarsest (early-founded) fibres seem to have first call on available nutrients. This results in an unfavourable change in the quality of the fleece. Quality is also affected by breaks, tenderness, cotting, and uneven crimping caused by irregular growth of the fibres.

Variations of Growth Rate

Apart from the kemps in the fleece, the fibres normally continue to grow indefinitely and, if the level of nutrition is adequate, at a constant rate. Under experimental conditions fleeces have been grown for 3 to 4 years, weighing up to 70lb. and showing almost perfectly regular growth. Fig. 2 shows variations in the weight of wool grown per month by Romney ewes under conditions of unrestricted grassland feeding. Perfectly regular growth throughout the year is unusual, and a depression in growth rate corresponding with the end of pregnancy and the beginning of lactation occurs commonly, usually manifesting itself as a "break" in the staple. At present the cause of this break is not known, but a sudden drop in feed supply, a change to poor-quality feed, or illness is known to be capable of causing a severe break at any time.