BREEDING PROBLEMS
WITH ANGORA GOATS

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Since its domestication the goat has served man well. As a source
of milk, meat, mohair, and skins it has furnished him both food and
clothing, and because of its brush-eating proclivities, has spared him
untold amounts of hard labor with the brush hook.

Since 1900 the Angora goat industry in the United States has under-
gone rapid expansion. At present it is confined largely to the South-
western States, nearly 90 percent of all Angoras being produced in
Texas, New Mexico, and Arizona. The estimated average yield of
mohair per goat in 1935 was 4.4 pounds although the average yield
in some of the better flocks was probably twice as great. Practically
all improvement has come about through practical breeding. In
comparison with other farm animals, little in the way of scientific
research has been done with the Angora goat. The Texas Agricultural
Experiment Station is the only place in the United States where experi-
mental work is now known to be conducted with this breed. Re-
search is badly needed on problems pertaining to the development of
strains yielding larger amounts and a better quality of mohair. Tech-
niques have been developed for the study of mohair that, combined
with the proper genetic research, offer possibilities of improvement
yet unrealized.

It is quite certain that the goat was one of the first domestic animals.
In all probability, it was first domesticated in western Asia, and from
there it was brought into Africa and other countries. After centuries of
selection, the domestic goat is very different from its wild ancestor.

The goat is probably descended from the pasang or Grecian ibex
(Capra hircus aegagrus), a species of wild goat found in Asia Minor,
Persia, and contiguous countries. It appears unlikely that any wild
species other than the pasang had an appreciable part in the ancestry
of the domesticated goat, although for some breeds, as the Malayan,
Cashmere, and Angora goats, the evidence is not so convincing that
this form was the sole ancestor. It is possible that the ibex and markhor
may have been represented in the ancestry of these breeds, for Lydek-
ker (9)1 states that both of these forms will breed readily in confine-
ment with domesticated goats.

The development of the long-haired type of goats was accomplished
centuries ago, principally in Asia Minor, where the Province of
Angora gave its name to the best known of such breeds. How the
short hair of the pasang and other possible ancestral forms developed

1 Italic numbers in parentheses refer to the Bibliography p. 1292.

1280
into the long hair characteristic of the Angora goat is not clear, but it seems most likely that it was simply by the selection of animals with variations in length of hair. Whether a single major mutation accounted for the change, as appears probable for long-haired types in the rabbit and the guinea pig, is unknown, but it would seem certain that the selection of minor variations in length of hair has modified the character in the desired direction.

According to Willingmyre, Window, Spencer, and others (20), the original Angora goat was described as a comparatively small animal with a fine lustrous, silky fleece that hung in ringlets and attained a length of 8 to 10 inches. In the early part of the nineteenth century the demand for raw mohair became so great that the Turks, who were the original breeders of the Angora, were unable to increase their herds rapidly enough to meet the demand. This resulted in hybridization of Angora bucks with common Kurd does in an effort to increase the number of mohair-producing animals quickly by grading up the common goats of the region. This practice became so prevalent that purebred Angora goats were practically eliminated. However, the new type of Angora developed from these cross-breds is a larger and hardier animal that yields a heavier though somewhat coarser fleece than the original Angora.

THE DISTRIBUTION OF ANGORA GOATS FROM ASIA MINOR

Although the Angora goat was developed in Asia Minor centuries ago, its spread into other portions of the world is relatively quite recent. The first European record of the Angora goat appears in 1554 when, according to Cronwright Schreiner (2), the Dutch ambassador at Constantinople procured a pair of Angoras and sent them to the Emperor, Charles V. However, mohair yarn was known before this date in Europe. Following this early importation of Angora goats

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The use of mohair can be traced to the time of Moses. The Bible records that Moses commanded the children of Israel, after being delivered from slavery in Egypt, to bring white silk and goats' wool to weave altar cloths for the tabernacle (20).

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ONE of the most urgent needs for breed improvement in all branches of livestock, including mohair goats, is the development of more and better criteria for the selection of breeding animals. Too generally, selection is based solely upon the animal's appearance, or phenotype, and it is a well-known fact, substantiated both by practical experience and by genetic evidence, that appearance is not always a good criterion of an animal's breeding worth. It is of value and must be taken into account, but it is only a part of the story. The question is, not what an animal looks like, but what inheritance it will pass on; and it is impossible to determine this from appearance.
to Europe, many attempts were made to establish them but without success until the nineteenth century.

In 1838 Angora goats were first introduced into South Africa. These goats were crossed with native goats and by a process of selection and inbreeding, herds of high merit were established. The goats were prized by the Boers, not so much for their mohair, but, according to Rose (12), because the infusion of the Angora blood into the native herds made the cross-bred goats less subject to cutaneous diseases and more able to resist scab. The cross-breds were also earlier maturing and heavier than the native goats, and their flesh was more palatable. No more importations were made into South Africa until 1856, but after that date several were made and the industry has grown until today South Africa, Turkey, and the United States are the countries producing the largest quantities of mohair.

The first importation of Angoras into the United States was made in 1849 by James C. Davis of Columbia, S. C. It consisted of nine choice animals—seven does and two bucks. These goats were exhibited at many fairs, where they won numerous prizes and received much publicity, with the result that great interest was stimulated in Angora goats.

In 1860 a second importation of 8 Angoras was made by William Henry Stiles of Cartersville, Ga., this being followed by an importation of 67 goats by Winthrop W. Chenery of Belmont, Mass., in 1861. In the next decade several importations were made, including one by Israel S. Diehl, who had been commissioned by the United States Commissioner of Agriculture in 1867 to visit the Province of Angora for the purpose of investigating the mohair industry.

During the 30 years from 1870 to 1900 several small importations were made by various breeders, mostly bucks to be used in the importers' herds. In 1904 one of the largest and most notable of all importations, consisting of 148 goats, was made by G. A. Hoerle of Midland Park, N. J. This shipment, which came from South Africa, was made possible by the temporary suspension during the Boer War of the very high export duty of 100 pounds sterling on each Angora goat by the South African Government. Soon thereafter the exportation of Angora goats was prohibited from South Africa and this embargo remained in effect for nearly 20 years.

Recent importations of Angora goats have been few and limited to a small number of individuals, mostly bucks. The latest importation from South Africa was made by E. Cawood into Texas in 1925.

THE ANGORA GOAT INDUSTRY IN THE UNITED STATES

Following the Civil War the growing of Angora goats spread into many parts of the country and the number of goats increased rapidly. Introduction into new regions was at first largely for the purpose of brush extermination on new lands being opened for settlement in the West. In some regions where these goats proved to be well adapted, however, an interest in Angoras for the production of mohair developed, and the industry has finally become firmly established in certain sections.

Since 1900 the industry in the United States has undergone rapid expansion. The number of Angora goats increased from 329,300 in
ANGORA GOATS

1900 (1) to 2,101,591 in 1920 and to 3,785,127 in 1930 (14). Figures showing the status of the Angora goat industry in the United States in 1930 are given in table 1.

Table 1.—The status of the Angora goat industry in the United States in 1930

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Angora goats</th>
<th>Angora goats by regions</th>
<th>Total farms in the United States</th>
<th>Farms reporting Angora goats</th>
<th>Average per farm reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>Texas</td>
<td>2,855,384</td>
<td>78.1</td>
<td>485,489</td>
<td>9,287</td>
<td>1.9</td>
</tr>
<tr>
<td>New Mexico</td>
<td>198,089</td>
<td>5.1</td>
<td>31,439</td>
<td>1,177</td>
<td>3.7</td>
</tr>
<tr>
<td>Arizona</td>
<td>193,320</td>
<td>5.1</td>
<td>14,173</td>
<td>590</td>
<td>4.2</td>
</tr>
<tr>
<td>Oregon</td>
<td>119,341</td>
<td>3.2</td>
<td>55,153</td>
<td>2,895</td>
<td>5.2</td>
</tr>
<tr>
<td>Missouri</td>
<td>76,830</td>
<td>2.1</td>
<td>255,940</td>
<td>3,454</td>
<td>1.3</td>
</tr>
<tr>
<td>California</td>
<td>45,266</td>
<td>1.2</td>
<td>135,676</td>
<td>1,025</td>
<td>.8</td>
</tr>
<tr>
<td>All other States</td>
<td>198,118</td>
<td>5.2</td>
<td>5,300,813</td>
<td>15,951</td>
<td>.3</td>
</tr>
<tr>
<td>United States</td>
<td>3,785,127</td>
<td>100.0</td>
<td>6,288,648</td>
<td>34,379</td>
<td>.5</td>
</tr>
</tbody>
</table>

From these figures it is apparent that Angora goat production is largely confined to the southwestern part of the United States; and that Texas had over 78 percent of all Angora goats in 1930, with New Mexico and Arizona accounting for over 10 percent of the remaining goats. In Texas the majority of the goats are raised in the Edwards Plateau area in the southwestern part of the State, where they are kept in large numbers on ranches. In Arizona and New Mexico similar conditions exist, this method of production being responsible for the large number of goats reported per farm in those States.

Since 1930 there has been some decline in the total number of Angora goats in common with a reduction in number for most classes of livestock. The 1935 census of agriculture listed 4,093,441 goats of all kinds in the United States, whereas in 1930 a total of 4,821,294 were listed. If there was a proportionate reduction in the number of milk and Angora goats the approximate number of Angora goats in the United States in 1935 was 3,211,000.

The production of mohair and estimated average weight of mohair fleeces at 5-year intervals since 1920 for the six leading States are shown in table 2. While the total production of mohair increased in proportion with the increase in number of goats, it may be noted that the average production per goat did not increase greatly, although there was a slight, but not constant, increase in average fleece weight. For some States, notably Texas, New Mexico, and Oregon, the average weight of fleece was greater than for other States. The reason for this is not apparent, but it is probable that both better breeding and better management were responsible. For instance, Angora goats in Missouri are kept in small herds principally for the purpose of clearing brushland, whereas in Texas and some of the other States they are kept in large herds primarily for the production of mohair. It is to be expected that in Texas more careful attention will be given to the selection of breeding stock, as well as to providing conditions most favorable for mohair production.

In addition to its value as a producer of mohair, which is a very important textile fiber, the Angora goat is useful for clearing brush.
from virgin land (fig. 1 illustrates the feeding habits of the animals) and it is a valuable source of meat. During the fiscal year ended June 30, 1936, a total of 51,461 goats were slaughtered in packing plants under Federal inspection (13, p. 27), a large proportion of which were

Angora goats. This meat, sometimes known as chevon, is similar in flavor to lamb and mutton.

**Table 2.**—Production of mohair (including kid hair) and estimated average weight of mohair fleeces per goat in the 6 leading producing States at 5-year intervals from 1920 to 1935, inclusive

<table>
<thead>
<tr>
<th>State</th>
<th>1920 Production</th>
<th>Fleece weight</th>
<th>1925 Production</th>
<th>Fleece weight</th>
<th>1930 Production</th>
<th>Fleece weight</th>
<th>1935 Production</th>
<th>Fleece weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas</td>
<td>6,786 pounds</td>
<td>3.7 Pounds</td>
<td>8,549 pounds</td>
<td>4.6 Pounds</td>
<td>14,800 pounds</td>
<td>4.2 Pounds</td>
<td>13,000 pounds</td>
<td>4.6 Pounds</td>
</tr>
<tr>
<td>New Mexico</td>
<td>397 pounds</td>
<td>3.2 Pounds</td>
<td>444 pounds</td>
<td>3.7 Pounds</td>
<td>815 pounds</td>
<td>3.9 Pounds</td>
<td>920 pounds</td>
<td>4.1 Pounds</td>
</tr>
<tr>
<td>Arizona</td>
<td>464 pounds</td>
<td>3.2 Pounds</td>
<td>399 pounds</td>
<td>3.7 Pounds</td>
<td>900 pounds</td>
<td>4.0 Pounds</td>
<td>480 pounds</td>
<td>3.2 Pounds</td>
</tr>
<tr>
<td>Oregon</td>
<td>455 pounds</td>
<td>4.0 Pounds</td>
<td>452 pounds</td>
<td>4.2 Pounds</td>
<td>450 pounds</td>
<td>4.0 Pounds</td>
<td>531 pounds</td>
<td>3.8 Pounds</td>
</tr>
<tr>
<td>Missouri</td>
<td>145 pounds</td>
<td>2.5 Pounds</td>
<td>183 pounds</td>
<td>2.8 Pounds</td>
<td>158 pounds</td>
<td>2.5 Pounds</td>
<td>210 pounds</td>
<td>2.5 Pounds</td>
</tr>
<tr>
<td>California</td>
<td>230 pounds</td>
<td>3.6 Pounds</td>
<td>220 pounds</td>
<td>4.4 Pounds</td>
<td>140 pounds</td>
<td>3.5 Pounds</td>
<td>133 pounds</td>
<td>3.8 Pounds</td>
</tr>
<tr>
<td><strong>Total or average</strong></td>
<td><strong>8,474 pounds</strong></td>
<td><strong>3.6 Pounds</strong></td>
<td><strong>10,432 pounds</strong></td>
<td><strong>4.4 Pounds</strong></td>
<td><strong>17,308 pounds</strong></td>
<td><strong>4.1 Pounds</strong></td>
<td><strong>15,074 pounds</strong></td>
<td><strong>4.4 Pounds</strong></td>
</tr>
</tbody>
</table>

Bureau of Agricultural Economics, U. S. Dept. of Agr.
Goat meat, according to Williams (19), goes quite generally into the regular meat trade. In cities and towns in the range districts Angora wethers are marketed freely as such and the meat is consumed without discrimination by the buyer. According to some buyers properly finished goat meat has a sweetness lacking in mutton. Studies by Miller indicate that the flavor of the meat from kids and lambs is very similar; in fact, the flavor was identical as far as the committee judging the two types of meat could decide. The goat meat was a little coarser in texture and for the older goats was graded as slightly tougher and somewhat drier. In eastern markets the status of goat meat has never been established and occasional efforts to sell it in these markets have been disappointing.

In general the goat carcass is not so well-fleshed, it is not susceptible of so high a finish, nor is the dressing percentage so high as that of the average sheep carcass. The selling price of the Angora wether is about 60 percent of that of the sheep wether where large numbers are sold. The lower price of chevon meat is attractive to consumers, and the quality of the meat is probably superior to that of mutton that could be obtained for the same price (19).

**Improvement Brought About by Selective Breeding**

The improvement of Angora goats in the United States has come about through selective breeding. Following the early importations, imported bucks were used extensively on a foundation of common short-haired does. Through selection and the use of imported bucks improvement progressed until the supply of high-class stock is now so plentiful that cross-breeding is seldom practiced. At present the chief method of breed improvement is based on a program of selection within purebred Angora stocks. Figure 2 shows a buck and a doe representative of the breed.

For the most part, the range herds of Angoras are composed of high-grade does that are mated with purebred bucks obtained from breeders who specialize in the production of registered animals. Most of these breeders are in the States of Texas, Oregon, New Mexico, and Arizona.

**Agencies That are Sponsoring Breed Improvement**

In 1900 the American Angora Goat Breeders' Association established a registry system for Angora goats. The foundation animals admitted to registry were chosen after official inspection of high-grade American Angoras, and only animals conforming to the standards required by the association were admitted. From 1900 to 1924 all goats registered by this association traced to these foundation animals or to Angoras imported during this period. In 1918 another association, the National Angora Record Association, was organized and incorporated under the laws of Texas, but this association merged with the American Angora Goat Breeders' Association in 1924. At present the latter association is the only organization registering Angora goats in the United States. Up to 1937 a total of about 170,000 Angora goats have been registered. Claudine Bourland of Rock Springs, Tex., is the secretary of this association. The directory of the association, pub-

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lished in October 1934, lists a total of 353 members, 266 of whom are in Texas.

Other organizations that are active in sponsoring Angora goat breeding and improvement are the Arizona Mohair Growers' Association and the Texas Sheep and Goat Raisers' Association.

The Angora Journal, published at Portland, Oreg., by A. C. Gage, is the only journal in the United States that specializes exclusively

on the promotion and improvement of Angora goats. The Southwestern Sheep and Goat Raisers' Magazine is the official publication of the Texas Sheep and Goat Raisers' Association.

RESEARCH, INCLUDING THAT AT FEDERAL AND STATE STATIONS

Research pertaining to Angora goats either by States or by the Federal Government is very limited. At present, only three projects are listed in the Office of Experiment Stations that deal with Angora goats, and these are all being conducted at the Texas Agricultural Experiment Station. They cover:

1. The inheritance of type in Angora goats.
2. Inheritance of the ridgling characteristic in goats.
3. Cytological and hybridization studies with goats.

In 1915 the Texas Agricultural Experiment Station established a branch experiment station, generally known throughout the Southwest as the Ranch Experiment Station, in the Edwards Plateau section midway between Sonora and Rock Springs (fig. 3). Much

\footnote{Ridplings or "rigs" are animals characterized by cryptorchidism, the condition in which one or both testes fail to descend into the scrotum. Usually it involves but one testis, but occasionally both.}
of the research at this station has been devoted to a study of Angora goats and mohair, and several bulletins have been published dealing with various aspects of mohair production, particularly studies on the influence of such factors as age, sex, individuality, and pregnancy upon the quantity and quality of mohair produced. The Bureau of Animal Industry of the United States Department of Agriculture has cooperated in some aspects of these investigations, chiefly on studies pertaining to quality of mohair.

Several years ago the Oregon Agricultural Experiment Station maintained an experimental herd of Angora goats, but with the curtailment of funds for research that followed the depression, this herd was disbanded.

**RESULTS OF THE GERM-PLASM SURVEY**

As a part of the survey of germ plasm in animals and plants, the Department of Agriculture sent questionnaires to agricultural experiment stations in those States where Angora goats are of considerable economic importance and also to all prominent breeders whose names could be obtained. The breeder was asked for information concerning (1) the size of his herd, (2) the number of purebred and grade goats in the herd at present and during each of the last 5 years, (3) the total yield of mohair for each of the last 5 years, (4) the number of sires used in the herd, (5) the proportion of single and multiple births observed during the last 2 years, (6) the names of any outstanding strains bred by him, and (7) whether he was practicing inbreeding. If he was practicing inbreeding the breeder was requested to furnish pedigrees of several of his most highly inbred animals.

There were very few returns from the questionnaire, and as a result no very definite conclusions can be drawn. Some breeders
reported that they were practicing some inbreeding, but no pedigrees from which the degree of inbreeding could be determined were included in their replies. Nor is this information available anywhere in published form, since the record association does not publish herd-books. While a few breeders have attempted to develop and maintain certain breed lines, the number of attempts to do this is small and no families that could be compared with some strains of cattle—as, for instance, the Anxiety 4th Herefords—were reported. It is improbable that such strains exist among Angora goats. Some breeders follow the plan of using bucks produced in their own herds; others the plan of purchasing sires from other herds; while some use a combination of both plans. Since no importations have been made in recent years, little improvement has recently been accomplished in this manner. Apparently there has been a tendency among Angora breeders to breed for definite points such as certain fleece types, the elimination of beards, etc., rather than for the development of breed lines of especial merit.

From the data submitted it is apparent that mohair production in the flocks of the better breeders is much above the average reported in table 3. Two breeders reported an average annual production per goat during the last 5 years of over 7½ pounds; others, an average annual production of over 6 pounds. These figures are from 2 to 3 pounds, or some 40 to 70 percent, above the estimated average production for all Angora goats.

No great tendency was observed in any of the herds reported for the production of multiple births. A considerable reduction has been made in the size of some purebred flocks since 1930.

GENETIC AND FLEECE STUDIES ON THE ANGORA GOAT

Only a few investigators have studied the genetics of the Angora goat and most of the studies reported thus far are in their preliminary stages. Warwick (16) found that the presence of horns is dominant to hornlessness in the Angora and he suggests that one major factor governs the inheritance of this character, although the data are too few to allow for definite conclusions. Most purebred Angora goats have horns.

Cryptorchidism, an inherited defect that is quite common in Angora goats, has been investigated by Lush, Jones, and Dameron (8), and by Warwick (15). The exact mode of inheritance is not known, and its determination is difficult since the defect can be observed only in the male. The condition is recessive and at least two pairs of factors are involved.

The mode of inheritance of fleece length has not been determined, but Davies (3) states that the long-haired condition appears to be recessive. From the meager evidence available, however, it seems probable that hair length is determined by multiple factors.

The effect of individual differences and of such factors as age, sex, pregnancy, and lactation on the quality and quantity of fleeces produced by Angora goats has been investigated by Lush and Jones (7), and by Jones, Warwick, Dameron, and Davis (6). The studies by Lush and Jones show that about 17 percent of the differences in fleece weight produced by goats similar in age, sex, and general breed-
ing is permanent throughout the life of an individual and hence is subject to selection. The exceptional individual is of more importance in the less uniform flocks, and it is in such flocks that selection would be most effective. It was determined, furthermore, that permanent differences in fleece weight show up less accurately at first shearing than at later shearings and that they show more accurately at the fall yearling shearing, usually the second shearing, than at any other age. This is an important determination from the breeder's standpoint since culling at this age will result in the selection of those goats with the greatest inherent mohair production.

Jones, Warwick, Dameron, and Davis (6) found that the age of the animal had a marked influence on both the unscoured and the clean weight of the fleece, the weight increasing to a maximum at 3 years, after which it becomes steadily less. Diameter of mohair fiber and body weight were shown to increase until the animal reached 8 years of age. Length of staple, amount of kemp or coarse inferior hair in the fleece, and the extent of belly covering were somewhat less influenced by the age of the animal. Staple length reaches its maximum the first year and the mohair produced during the first year is of somewhat better quality than that produced later.

The body weight of bucks was found to be about 23 percent greater than that of does, while their fleece weights averaged about 18 percent greater unscoured and 29 percent greater when clean. The diameter of fiber was observed to be coarser in the fleece of the male but the staple length was somewhat less. Pregnancy was shown to reduce the fleece weight, as did the suckling of young. A somewhat similar effect of pregnancy was observed upon staple length although this effect is more pronounced in younger than in older animals.

Attempts to Cross the Sheep and Goat

Various investigators (11) have described apparent sheep-goat hybrids and a few writers have stated that such hybrids are rather common in some sections. Other workers have questioned these conclusions, and in the light of controlled attempts to make this cross it is probable that living hybrid offspring are rare, if they exist at all.

Heller, cited by Poponoe (10), reported that attempts to make such crosses between Barbados sheep and the goat in the laboratories of the Bureau of Animal Industry were unsuccessful. Recently Warwick, Berry, and Horlacher (18) described attempts to cross Angora does with rams, mostly of the Merino breed. In all 38 such matings were made. In 21 females it was determined that fertilization and implantation of the egg took place, but in no case were living young obtained. Two of these does were sacrificed, one 44 days after breeding and the other 62 days after mating. In both cases apparently normal embryos were found. The causes for the early death of the hybrid fetuses have not been determined.

Not all rams that were tried would mate with the does and, contrary to general opinion, Angora males would not mate with ewes. However, one Angora male that was raised on a sheep foster mother was mated with 17 ewes, but there is no evidence that fertilization occurred in any of these cases (17).
OPPORTUNITIES FOR FURTHER IMPROVEMENT

It is apparent from the facts presented here that credit for improvement of Angora goats must go to private breeders, past and present, who alone have been responsible for bringing this breed to its present development. But improvement is now very slow, and if further progress is to be stimulated and encouraged, new measures are called for. On this point few will disagree, but the breeder may well ask what steps can be taken to bring about further improvement. It must be confessed that there is no single easy formula. If further improvement is desired, what will be needed is a program that includes the active cooperation of breeders, breed associations, State and county extension workers, and finally, the research staffs of State and Federal experiment stations.

No attempt will be made here to outline a research program for Angora improvement, but some of the points that need be considered will be briefly discussed.

One of the most urgent needs for breed improvement in all branches of livestock husbandry at the present time is the development of more and better criteria for the selection of breeding animals. Too generally, selection is based solely on the animal's appearance, or phenotype, and it is a well-known fact, substantiated both by practical experience and by genetic evidence, that appearance is not always a good criterion of an animal's breeding worth. It is of value and must be taken into account, but it is only part of the story. The question is, not what an animal looks like, but what inheritance it will pass on; and it is impossible to determine this from appearance. How to determine it is a question that science is as yet far from having answered in the case of animals. Research workers are attacking the problem, however, and eventually methods should be devised for determining and evaluating the factors of greatest importance in the selection of breeding stock.

Meanwhile, in spite of present uncertainties, it is known that the progeny test is important in evaluating breeding animals. To use the progeny test properly, however, requires the development of better records than those that now exist for mohair production. This is one part of an improvement program in which the practical breeder can cooperate to advantage with the scientist. Before such tests are undertaken, however, careful thought must be given to the kind of records that will be of the greatest use.

To use the progeny test most effectively the breeder must have accurate data on the offspring of his herd sires. Among the records of most importance are quality of mohair, freedom from kemp, uniformity of body covering, and yield of mohair determined on a clean basis. While facilities are probably not now available for securing all such information, records could undoubtedly be obtained if there were a sufficient demand for them. In addition to their value to the breeder in the selection of sires, such records would be of use to the scientist in getting at the basic physiological problems concerned in mohair production; and a more complete knowledge of such factors is essential to continued progress.

Very little information exists concerning the inheritance of any characters in the goat and particularly of those characters that are
concerned in the production of good fleeces. Research in this field is badly needed, since progress in breeding for fleece improvement must ultimately depend on a better understanding of the genetic factors involved. As an example, take the appearance of kemp in the fleece (fig. 4). The elimination of kemp fibers, which greatly reduce the value of the fleece, is one of the most important problems in Angora goat improvement. Until it is known how the kemp-producing characteristic is inherited, it can hardly be eliminated from herds.

There are now outstanding animals in the herds of many breeders, but along with them there are many mediocre and some inferior animals. If it were possible for the breeder to increase the uniformity of the animals in his flock it would be a decided step forward. Little is now known of the factors making for uniformity of fleece type, although this question is of vital concern to the breeder and the producer alike. Research that will lead to the development of methods for improving uniformity in flocks is badly needed.

These are two problems that should form part of a research program. Others might be discussed, but enough has been said to indicate the need for a scientific approach to the problem of improvement. Research commonly yields large returns for the funds and efforts expended, but the active encouragement of the industry is needed if an adequate research program for the improvement of Angora goats is to be carried on.

**Some Immediate Practical Steps**

In addition to sponsoring research Angora goat producers might foster improvement in other ways. One method that has particular merit would be the development of a system of recording based on

Figure 4.—Cross sections of mohair fibers showing (A) freedom from kemp and (B) the presence of many kempy fibers. The kempy fibers, which are short, coarse, and irregular, are characterized by a medullated or hollow central portion. They do not take dye readily, and because of this and their stiffness and poor spinning qualities, the presence of such fibers in a fleece lowers its value.
meritorious production of mohair similar to the register of merit for many breeds of dairy cattle. In such records secured weight, fineness, and uniformity of fleece and freedom from kemp should be particularly stressed. Other steps that would be helpful would be the inclusion of more information in pedigrees than they now contain, with provision for certification of production records by some competent and impartial authority. Since Angora goat breeders are concentrated in a relatively few States, it should be possible to arrange for such certification of records with a minimum of cost to breeders. Such programs have been developed for register-of-merit records for other animals, and a similar scheme could be easily devised that would meet the requirements for breeders of Angora goats.

Again, if mohair were sold on a quality rather than on a weight basis it would exert an influence toward improvement in the breed by stimulating producers to raise better goats. This is worth serious effort on the part of the breeders and their record association. The adoption of different methods for the awarding of prizes at shows would also be a step to encourage better breeding practices. More emphasis should be placed on the get of sires and on outstanding families, and prizes should be awarded to breeders on this basis. This is in line with the progeny test, and it would focus the attention of breeders on the breeding ability of their choice animals.

Many difficulties beset those who undertake the improvement of modern breeds of livestock. But in spite of the excellence of modern breeds, their inherent variability is still great and the opportunities for improvement are many. The situation is a challenge to breeder and scientist alike, and if any great progress is to be made they must work closely together.

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