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BLACK fibers
and
WHITE kemp

IN WYOMING WOOLS

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Black Fibers and White Kemps in Wyoming Wools

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Dark-colored fibers and white-kemp fibers are present in domestic wools—the wool trade regards them as serious defects. The pigmented fibers vary in color and shade from reddish brown through dark brown and black to dark gray and light gray. All such fibers are called "black fibers" in this report.

In wool textiles the degree of color in the fiber is related to the extent to which the color constitutes a defect under visual inspection, but the color of the cloth containing this fiber is really the dominant factor. In cloths dyed in dark colors, these black fibers are practically invisible, but in cloths of pastel shades or natural white, these fibers are obvious to the cloth buyer, who discriminates strongly against such contamination.

So strong is the antipathy towards these pigmented fibers that, according to a limited survey of the wool trade, many mills will not buy wool top containing black fibers, and others specify that the tops they order shall be "black-fiber-free". Enforcement of these criteria limits demand to a certain extent; consequently, prices are adversely affected.

It has been thought that black fibers in domestic wools were inevitable; that they were either the result of careless selection of breeding stock, or were due to stray fibers and staples from shorn black fleeces adhering to white fleeces on the shearing floor.

White-kemp fibers in processed wools also are extremely objectionable, constituting a bad defect which renders the scoured wool or noils containing them worth much less than white-kemp-free products.

This survey attempts to establish estimations of the extent to which three types of pigmented fibers—black-wool fibers, black-hair fibers and black-kemp fibers, along with unpigmented white-kemp fibers—are present in clips of mixed range wools grown in Wyoming.

*Resigned April 1, 1956.
DISCUSSION

A total of 497 samples of grease wool were drawn from 20 clips of mature ewe and yearling ewe fleeces grown in Wyoming. These samples were taken from the side, shoulder, thigh, foreleg (arm), and head areas. Other samples were drawn from tied fleeces.

These white-wool samples were examined for black-wool fibers, black-hair fibers, white-kemp fibers, black-kemp fibers, and vegetable fibers. Their populations were counted when present in the samples.

Several considerations are necessary before attempting to evaluate the results of these various defect-fiber population surveys.

It should be clearly understood that each of the several defect-fiber types was not found in all samples and that many samples did not contain any defect fibers at all.

The samples did not represent the fleece or the clip in their respective entireties; samples represented only the separate body areas from which they were drawn. It would be correct to assume, therefore, that the population results constituted general, though unreliable, clip indexes. This is because neither the relationship of the sample to the entire fleece nor the extent of contamination in the entire fleece has been established. In fact, the data contained in this study are inadequate to determine these facts.

Also, it should be kept in mind that the defect fibers were not scattered throughout the staples from base to tip. Practically all these fibers were found in the upper half of the staple, and actually most of them were found on or within the tip of the staple, which is the extreme outer half (0.5) to one inch.

Black-wool fibers were found lying on the extreme tips of the staple.
Black-hair fibers (medullated) were found on the upper half of the staple.
Black kemps appeared in the upper half of the staple but occasionally were found in the lower half.

White kemps were found scattered throughout the length of the staple, but by far the greater numbers were found in the staple tips and in the upper halves of the staples.

Vegetable fibers were found only in the upper half of the staple.

Because of the involved nature of the data, it was decided to make use
of only the proportion (percentage) of contaminated samples found in the entire sample numbers within groups, in the "Conclusions". The data in Table 1 have been compiled in the "Conclusions" for the convenience of the reader.

### TABLE 1—Proportion of Samples Containing Defect Fibers in Total Number of Samples Within Groups

<table>
<thead>
<tr>
<th></th>
<th>Mature-ewe fleece samples (Percent)</th>
<th>Yearling-ewe fleece samples (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Black-wool fibers on staple tips of:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>side samples</td>
<td>21.4</td>
<td>50.8</td>
</tr>
<tr>
<td>thigh samples</td>
<td>63.0</td>
<td>62.9</td>
</tr>
<tr>
<td>tied-fleece samples</td>
<td>69.0</td>
<td>79.3</td>
</tr>
<tr>
<td><strong>Black-hair fibers on staple tips of:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>side samples</td>
<td>25.0</td>
<td>14.0</td>
</tr>
<tr>
<td>thigh samples</td>
<td>25.0</td>
<td>8.4</td>
</tr>
<tr>
<td>tied-fleece samples</td>
<td>48.0</td>
<td>43.9</td>
</tr>
<tr>
<td><strong>White-kemp fibers on staple tips of:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>side samples</td>
<td>87.0</td>
<td>93.0</td>
</tr>
<tr>
<td><strong>White-kemp fibers within staples:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>side samples</td>
<td>40.0</td>
<td>50.0</td>
</tr>
<tr>
<td>arm samples</td>
<td>54.0</td>
<td>57.0</td>
</tr>
<tr>
<td>head samples</td>
<td>85.0</td>
<td>79.0</td>
</tr>
<tr>
<td><strong>White-kemp fibers within staples:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>side samples</td>
<td>94.0</td>
<td>80.0</td>
</tr>
<tr>
<td>thigh samples</td>
<td>90.0</td>
<td>94.0</td>
</tr>
<tr>
<td><strong>Samples having black kems in staples:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>side samples</td>
<td>25.0</td>
<td>None</td>
</tr>
<tr>
<td>thigh samples</td>
<td>23.0</td>
<td>None</td>
</tr>
<tr>
<td><strong>Samples having black kems in:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tied fleeces</td>
<td>20.0</td>
<td>21.0</td>
</tr>
<tr>
<td><strong>Samples with vegetable fibers within staples:</strong></td>
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<td></td>
</tr>
<tr>
<td>side samples</td>
<td>46.0</td>
<td>32.0</td>
</tr>
<tr>
<td>arm samples</td>
<td>6.0</td>
<td>14.0</td>
</tr>
<tr>
<td>head samples</td>
<td>3.0</td>
<td>11.0</td>
</tr>
</tbody>
</table>

These defect fibers are discussed in their several categories.

### CONCLUSIONS

With the above considerations in mind, the following conclusions are drawn based upon the results of this work.

1. **Incidence of Black-Wool Fibers** (see Fig. 2)

   Black-wool fibers growing in association with white-wool fibers in staples of fleeces from white-faced range sheep are comparatively rare; therefore, as a defect fiber they are of no significance from the commercial standpoint. In only 4 samples out of a total of 497 were these inherent black-wool fibers found—one sample contained 2 black-wool fibers, and 3 samples contained 1 black-wool fiber each. It is superfluous to calculate the incidence (percentage) of those
particular black fibers among the white-wool fibers composing the samples.

Independent black-wool fibers (from extraneous sources) attached to the staple tips of the fleece constitute practically all of this particular defect in Wyoming wools when only white-faced wool breeds of sheep are involved.

These independent black-wool fibers adhere to the tips of some white fleeces when the white-wooled sheep come in contact with the black-wooled sheep that are used as markers in Western range flocks. Black-wool fibers were found on the staple tips of 21.4 percent of the mature-ewe fleece samples drawn from side body areas during two shearings and on the staple tips of 50.8 percent of side samples from yearling-ewe fleeces (see Table 1).

In the two instances in which black markers had been eliminated from the flocks for at least 12 months before shearing, neither black-wool fibers nor black-hair fibers were present on staple tips or within the staples.

From these results it appears that black sheep in flocks (see Figure 1) are the main source of contamination of white wool with black fibers. These black fibers in the white wool are a serious defect in woolen fabrics.

In order to produce wool that is black-fiber free, black sheep should be eliminated from flocks of white-fleeced sheep.

In wool samples from the thigh areas of mature-ewe fleeces and yearling-ewe fleeces, black-wool fibers were found on staple tips in greater numbers on an average than on staple tips of side samples. Totals of 63.0 percent of mature-ewe thigh samples and 62.9 percent of yearling-ewe thigh samples were found to have black-wool fibers adhering to their staple tips.

In random-drawn samples from tied mature-ewe fleeces comparatively large black-wool fiber populations were found on staple tips. (The comparison is made with the proportions of ewe and yearling-ewe side samples containing black-wool fibers on staple tips.) In these fleeces black-wool fibers were found on staple tips of 69.0 percent of the samples, and in yearling-ewe wool 79.3 percent of the samples had black-wool fibers on the tips. (See Table 1 for comparisons.)

As a general rule, thigh samples and
tied-fleece samples had more extensive contamination with black-wool fibers than had the side samples. (Side 21.4%, 50.8%. Thigh 63.0%, 62.9%. Tied fleece 69.0%, 79.3%. See Table 1.)

**2. Black-Hair Fibers** (Fig. 3)

Black-hair fiber populations were found in appreciable size on staple tips of mature-ewe fleece samples and of yearling-ewe fleece samples from side areas. In numbers these black-hair fibers were present in fewer samples than were the black-wool fibers. Only 25.0 percent of side samples from mature-ewe fleeces and 14.0 percent of samples from yearling-ewe fleeces contained black-hair fibers on staple tips.

Black-hair fiber populations on staple tips of thigh samples were found in fewer samples than black-wool fiber populations on staple tips of the same samples. On an average 25.0 percent of the thigh samples from mature-ewe fleeces and 8.4 percent of the thigh samples from yearling-ewe fleeces were found to contain black-hair fibers within staple tips.

More samples from tied fleeces were found to have black-hair fiber populations within staple tips than were present in thigh or side samples. Totals of 48.0 percent of samples from tied mature-ewe fleeces and 48.9 percent of samples from tied yearling-ewe fleeces carried black-hair fibers on the staple tips.

In general, black-hair fiber populations were found to be more numerous in samples from tied fleeces than in either thigh samples or side samples. (Side 25.0%, 14.0%. Thigh 25.0%, 8.4%. Tied fleece 48.0%, 43.9%. See Table 1.)

**3. White-Kemp Fibers** (Fig. 4)

Populations of white-kemp fibers occurred in comparatively high proportions on staple tips of side and thigh samples from mature-ewe fleeces and from yearling-ewe fleeces. Among samples from mature-ewe fleeces, 87.0 percent, and from yearling-ewe fleeces 93.0 percent, were found with white-kemp fiber populations on their staple tips.

Within staples, white-kemp fiber populations were found in roughly half of the side samples from mature-ewe and yearling-ewe fleeces in another section of the survey. Arm samples from the same fleeces exhib-
imited slightly greater incidence of white-kemp populations, but head samples from these fleeces had by far the greatest number of white-kemp fiber populations. Side samples from mature-ewe fleeces were found to have white-kemp populations in the proportion of 40.0 percent against 50.0 percent of samples from yearling-ewe fleeces. Arm samples from mature-ewe fleeces contained these fibers in 54.0 percent of the total samples, but head samples contained these populations in 85.0 and 79.0 percent of the total from mature-ewe fleeces and yearling-ewe fleeces respectively.

In another test, side and thigh samples yielded the greatest proportions of white-kemp populations of all samples having this contaminant. Ninety-four percent of mature-ewe side samples and 80.0 percent of yearling-ewe side samples contained white-kemp populations. Thigh samples from the mature-ewe fleeces had populations in 90.0 percent of their total. Thigh samples of the yearling-ewe fleeces had white-kemp populations in 94.0 percent of their total number.

From tied fleeces, samples containing white-kemp fiber populations also were extremely high, being 90.0 percent in the case of mature-ewe fleece samples and 94.0 percent in the case of the yearling-ewe fleece samples.

4. Black-Kemp Fibers (Fig. 5)

Black-kemp fiber populations were found in a moderate number of fleece samples. There appeared to
be much less black kemp in the samples than there was white kemp. In one section of the survey, black-kemp fibers were found in 25.0 percent of side samples and in 23.0 percent of thigh samples from fleeces of mature ewes. No black kems were found in side and thigh samples from yearling-ewe fleeces.

In samples of tied fleeces from mature ewes, black kems were found in 20.0 percent, and in samples from tied yearling-ewe fleeces, black kems were found in 21.0 percent.

In samples of tied fleeces from mature ewes, black kems were found in 20.0 percent, and in samples from tied yearling-ewe fleeces, black kems were found in 21.0 percent.

In one section of the survey, black-kemp fibers were found in 25.0 percent of side samples and in 23.0 percent of thigh samples from fleeces of mature ewes. No black kems were found in side and thigh samples from yearling-ewe fleeces.

In samples of tied fleeces from mature ewes, black kems were found in 20.0 percent, and in samples from tied yearling-ewe fleeces, black kems were found in 21.0 percent.

In samples of tied fleeces from mature ewes, black kems were found in 20.0 percent, and in samples from tied yearling-ewe fleeces, black kems were found in 21.0 percent.

6. Other Considerations

Black markers are carried in most of the range flocks in Wyoming in numbers that probably vary from approximately 5 to 14 per 1,000 head of white sheep.

Black-wool fibers and white kemps when present in shorn grease wools can be carried through the several processes of topmaking and they will appear as serious defects in the resulting tops, noils, and wastes, to the detriment of these products.

Considerable variation in incidence of the several defect fibers between flocks was noted during the course of this work. Although the results cannot be considered comprehensive in application, nevertheless it is not illogical to assume that these defect fibers will be found in practically all flocks of range sheep in Wyoming.

There is one exception to this assumption, namely, that in range flocks from which the black markers have been eliminated for at least 12 months before shearing, practically no black-wool fibers or black hair will be found in the shorn wool.

5. Vegetable Fibers (Fig. 6)

Populations of vegetable fibers within staples were found in side, arm, and head samples from mature-ewe and yearling-ewe fleeces. In the side samples from mature-ewe fleeces, 46.0 percent contained vegetable fibers, and 6.0 percent of the arm samples and 3.0 percent of the head samples contained vegetable fibers. In side samples from yearling-ewe fleeces, 32.0 percent contained vegetable fibers; 14.0 percent of arm samples and 11.0 percent of head samples also contained this defect.

Side samples appear to contain by far the greatest incidence of vegetable fibers.