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# Performance in Processing Wyoming Wools: Their Values and Types

By

Alexander Johnston

Robert O. Leonard

John T. Larsen

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# *Performance in Processing Wyoming Wools: Their Values and Types*

By *Alexander Johnston, Robert O. Leonard,* and *John T. Larsen*

Wool Specialists, University of Wyoming

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## DEDUCTIONS BASED UPON THESE STUDIES

By reason of the limitations in scope of these experiments and tests, it is felt that the findings should be called deductions instead of conclusions because of the decisiveness and finality of the latter term.

Because many novel facts concerning performance in processing of Western wools have been brought to light in this work, it is anticipated that these may form the bases for justification of future research in the various phases of wool production touched upon.

### Deductions from work on Objective A.

*To determine requirements for the preparation and refining of grease wool upon acceptable commercial bases*

1. Commercial sorting of graded wools preparatory to scouring and processing is much less intensive nowadays than it was 20 years ago and earlier. Modern mass-production methods have eliminated much of the costly sorting by hand, although not always to the benefit of the ultimate wool products.
2. Tags and stained wool, coarse breech wool, black locks, and strings appear to be the **only** sorts that should be removed from graded grease fleeces in modern commercial sorting practice (page 23). This fact not only has proof in the text of this report, but, since these tests were performed, the senior author has observed this practice in other commercial wool-processing establishments.
3. The amounts of the off-sorts removed in commercial sorting of these experimental lots rarely exceeded 4.0 percent by weight of the original graded lot, and more often these amounts were in the vicinity of 3.0 percent by weight. Of this quantity, fleece strings amounted to 0.25 percent by weight of the lot.
4. In all cases the amounts of noils produced in the combing process were much less than had been reported by mills for Wyoming wools in general. The amounts of noils (short fibers) combed from these Wyoming wools in this report were in most cases below 11.0 percent (noil on top-and-noil). Commercial interests had for years stated that Wyoming range wools noiled between 15 and 20 percent.

The amounts of noils and wastes for all lots covered by this work are condensed as follow:

| *Grade* | *Noil on top-and-noil (percent)* | *Total wastes (percent of scoured wool)* |
|---|---|---|
| Fine Staple | 8.92 | 6.64 |
| Fine French Combing | 11.48 | 7.01 |
| 1/2 blood Staple | 10.59 | 4.04 |
| 1/2 blood French Combing | 12.93 | 6.46 |
| 3/8 blood Staple | 7.22 | 3.50 |
| 1/4 blood Staple | 9.00 | 4.24 |

From these data a general deduction can be made that follows the accepted trade concept: namely, the shorter the wool, the greater the proportions of noils and wastes.

5. In general, all commercial charges for handling, processing, and selling the experimental lots of tops, noils, and wastes were higher than customary simply because the lots were small. The handler's charge of $2.72 per pound, grease basis, for handling, supervisory processing, and selling (experiment No. A1) becomes 11.59c per pound of top produced. Also, the products—tops, noils and wastes—were further penalized by a 1.0 percent selling discount.

   The authors found that, according to wool-trade opinion, it is not considered advisable to use below 5,000 lbs. of grease wool in testing the value of that particular grade or sort on the open market.

6. There are distinct quantitative differences between quality sorts derived from each graded lot of grease wool. This probably is due to the idiosyncrasies of the different graders and to subtle differences in physical characters of the grease wool that would be difficult for the layman to see.

7. According to the results of processing, (a) the amount of top derived appears to increase and the amount of noil to decrease with increase in fiber diameter in wools of Staple length, and (b) the shorter wools decrease in amount of top derived and increase in noil content compared with Staple wools within their respective grades.

8. Staple lengths of grease wools (unstretched) are closely related to the fiber lengths of their respective tops. Thus, unstretched Staple lengths of sorted lots have definite value as processing indices.

9. Fiber diameter of prepared scoured wools on an average is less than the average fiber diameter of the tops produced from them.

10. Compared with the original scoured wool, the fiber diameter of the carded wool is slightly greater (100.6 percent) and that

of the top distinctly greater (102.3 percent); on the other hand, burr-waste fiber is slightly smaller (99.1 percent), and card waste is much smaller (95.8 percent), while noils are finest in diameter of all (87.9 percent).

11. Because most of the experimental lots were small, they were discounted in price on the market. The only realistic array of cost data for wools sold on a volume basis was:

| | |
|---|---|
| Grading at shearing pens | 0.54c to 0.75c per pound, grease basis |
| Grading in wool warehouse | 1.50c per pound, grease basis |
| Freight, Wyo. to Boston, Mass | 2.84c to 2.89c per pound, grease basis |
| Sorting | 1.50c per pound, grease basis |
| Combing | 20c per pound of top produced plus 0.5c for each 1% noil |
| Appraisal of top contract lots | $30.00 per contract |
| Selling commission | 1.0c per pound |
| Handler's commissions | 3.7c to 4.0c per pound of top |
| | 5.0c per pound plus 1% discount for minor grades and wastes. |

For top-blending, transportation, storage, and broker's and handler's commissions, etc. the total cost ranged from 10.1c to 11.8c per pound of top.

Totals of all costs for preparing, processing, and marketing these wools on a volume basis varied from 16.0c to 19.8c per pound, grease basis, with an average cost of 17.6c.

12. The average amount of profit returned to six wool growers in combing experiment No. A2 was 3.70c per pound, grease basis (page 22), and the average amount of profit returned to the five wool growers in experiment No. A3 was 0.14c per pound, grease basis (page 29). Peculiarities surrounding experiment No. A1 precluded any accurate comparison of grease-wool values and processed-wool values.

13. Sorting out coarse, breech, and short wool from grease wool increased the value of the top produced by advancing the grade by one spinning-count class, i.e., from 62s top to 64s top and from 58s top to 60s top with corresponding value increases of 2.4 percent for Fine top and 7.7 percent for 1/2 blood top.

14. Taking out short wools in sorting significantly decreased the percentages of neps (tangled clumps of short fibers) by 39.8 percent and 29.5 percent in the two tests made. Neps in top also can be influenced by the

settings and the condition of the processing machinery.

15. Tops derived from two lots containing 10.0 percent and 25.0 percent tag wools sold for 6c per pound more than the control lot of 60s top containing no tag wool.

## Deductions from work on Objective B.

*To determine the feasibility of selling off-sorts and tags in scoured form*

1. By scouring tags before sale, an average net profit was returned to the wool growers of 9.8c per pound, grease basis, for 9 lots. Losses of 6.3 and 3.2c per pound, grease basis, were found for two lots. These losses may have been due to inefficiency on the part of the agency that sold these two lots.
2. A loss of 4.3c a pound, grease basis, or 16.3 percent, was incurred by scouring one-half of one lot of shearing-pen sweepings before sale.
3. Scoured-eye clippings brought 7.2c per pound, grease basis (14.4 percent), more than the highest offer the wool grower had received for his entire clip of ewe wool until the date on which the eyeclippings were sold.
4. Wool-trade recommendations are that all grease tags should be graded into Fine, Medium, and Coarse classes before they are either sold in the grease form or are scoured before sale.
5. All hairy breech wool and Staples and clumps of black or gray fibers should be carefully picked out during the sorting of tags.

## Deductions from work on Objective C.

*To study the economy of marketing paint-free and paint wools of the same clip*

Two lots of paint-free, scoured wools, one Fine and one 1/2 blood, were sold on the open market for 5.0c and 2.0c per pound more than their respective scoured counterparts containing the original paint brands; these amounts are equivalent to 1.75c and 0.76c per pound, grease basis, respectively.

## Deductions from work on Objective D.

*To study the feasibility of various methods of wool preparation, the most efficient utilization of off-sorts and minor grades, the measurements of various defects, and their effect upon purity of the processed products*

1. Sorting out coarse, breech, and short wools from graded wools increased the quality of the tops derived from 62s to 64s in Fine

and from 58s to 60s in 1/2 blood.

2. In the Fine lots, sorting out the coarse wools and short wools increased the value of the top by 2.4 percent and of the 1/2 blood top by 7.7 percent.
3. Sorting out short wools lowered the numbers of neps by 39.8 percent in Fine top and 29.5 percent in 1/2 blood top.
4. Tops made from blended 1/2 blood Staple stock and 10 percent and 25 percent scoured Fine tag wools were appraised at 6c per pound (3.2 percent) more than the pure 1/2 blood Staple top. This leads one to think that there is much good wool fiber in tags.
5. Yields of top from triplicate, homogenized Fine and Medium sorted lots showed that processing of duplicate samples was more reliable than using a single sample to obtain the processing index.
6. Two clips from among those reputed to be the best in Wyoming were analyzed by grade and sort. The findings were as follow:
   a. By grade, the Fine clip had only 56.0 percent of Staple wool and the 1/2 blood clip had only 51.0 percent of Staple.
   b. By sort, the Staple grades of the Fine clip yielded 86.8, 86.8, and 86.7 percent of Staple wools. Likewise the Staple grades of the 1/2 blood clip yielded 83.0, 80.9, and 74.6 percent of Staple wools.
   c. The Fine clip had 39.0 percent graded French Combing (medium length) wools and the 1/2 blood clip had 42.3 percent by weight.
   d. The Fine clip had no Clothing or Breech wools but the 1/2 blood clip had 3.3 percent by weight.
   e. There were 5.0 percent tags in the Fine clip and 3.4 percent in the 1/2 blood clip.
7. Six range clips were analyzed by taking one bag (approximately 30 fleeces) from each major grade, sorting each bag in the wool laboratory, and scouring the fleeces within each clip. The summarized results are as follow:
   a. **By grade** the Staple wools in these clips ranged from 26.3 percent by weight to 53.8 percent with an average of 29.6 percent.
   b. **By sort**, however, the total amount of Staple wools by clip varied from 21.1 percent by weight to 40.7 percent with an average of only 21.6 percent.
   c. French Combing sorts in these grades varied from zero to 32.2 percent by weight with an average of 17.5 percent by weight.
   d. Total amounts of medium-length wools (French Combing) by clip averaged 69.5

percent by weight of clip ranging from 46.5 percent to 100.0 percent.

e. Very short wools and tags varied from 2.7 percent to 12.6 percent with an average of 5.8 percent by clip weight.

f. The factors that detract from the values of most of these clips are (1) large amounts of medium-length and short wools present, (2) amounts of low-value tags present, and (3) the mixture of grades and sorts present which requires costly labor to separate before these wools can be processed.

# INTRODUCTION

The wool research reported in this bulletin was conducted between 1952 and 1958.

Wyoming grease wools were used in all experiments.

This work was undertaken because wool producers know little about the steps involved in refining grease wools into top and noil. It would establish the consecutive steps in modern wool processing which are practically unknown to the producer.

It is believed that, if the refining phase of the wool industry were better understood by producers, considerable progress could be made in producing and marketing superior wools that would be more acceptable to the trade and, more particularly, to the manufacturer.

If, through this work, wool growers could adopt superior production and preparation practices, they would benefit through larger returns.

## Objectives

A. To determine the requirements for the preparation and refining of grease wool upon acceptable commercial bases.

B. To determine the feasibility of selling off-sorts and tags in scoured forms.

C. To study the economy of marketing paint-free and paint wools of the same clip.

D. To study the feasibility of various methods of wool production, including the degree of preparation, the most efficient utilization of off-sorts and minor grades, and the measurements of various defects as well as their effect upon purity of the processed products.

The results of separate studies dealing with the above objectives are presented in the following pages.

Adverse circumstances precluded a fifth objective, "to study the feasibility of selling wool by public auction in local and central markets." The condition of the domestic wool market in 1952, 1953, and 1954 was depressed. Demands for grease wools were sporadic, and wool pri-

ces to growers were comparatively low compared with the high grease-wool values of the booming 1951 market. These circumstances, combined with the usual inefficiency of our wool-selling methods in producing areas, made experimentation in this field hazardous. Also, because large volumes of grease wools would be required to test the market in selling experiments, the risk was deemed too great for both the wool producer and the University.

Another objective, "To collect samples of the various types of grease wool grown in Wyoming and to measure their physical characters," was found impossible to accomplish. It was to be linked to the public-auction-sale objective but was to be dependent upon sampling of the accumulations of grease wools from many areas of the state. Because adverse circumstances prevented work on the public-auction-sale objective, this study of the wools produced in various areas of Wyoming was not attempted.

## DISCUSSION AND RESULTS OF OBJECTIVE A

Objective A. "To determine requirements for the preparation and refining of grease wool upon acceptable commercial bases."

### Experiment No. A1

An original-bag Fine-wool (Fine-crossbred) clip from the Rawlins area of Wyoming was processed into top and noil at an Eastern wool-processing plant.

This clip consisted of 200 bags of ewe wool and 30 bags of yearling ewe wool weighing approximately 91,013 pounds. The clip was scoured, carded, and combed in an Eastern topmaking plant.

1. SORTING. The sorting report is given in Table 1.

Important points follow:

(a) There was a gain in weight (moisture increase) of 1.12 percent between the weight of the wool at the shearing-pen (91,013 lbs.) and the total weight of the sorts (92,030 lbs.) at the mill.

(b) The two major sorts of combing wools constituted 89.2 percent of the clip, and the minor sorts 9.2 percent. Combined, these sorts comprised **98.4** percent. The minor sorts also could have been combed if the amounts had been larger.

(c) The off-sorts (grey, stained, tags) comprised only 1.3 percent.

(d) Strings (a component of shrinkage) comprised only 0.3 percent.

The clip originally contained 1,095 lbs. of black wool and 4 bags of tags and stained wool left out of the fleeces at the shearing shed.

2. COMBING. The main sorts—Fine Staple and Fine French

**TABLE 1—Mill sorting report of Original-bag Fine-wool clip**

| Sort | Net weight *(pounds)* | | Percentage of sort by weight |
|---|---|---|---|
| Fine Staple sort | 35,736 | Major sort | 38.8 |
| Fine French sort | 46,356 | " " | 50.4 |
| 60/62s sort | 2,019 | " " | 2.2 |
| 58/56s (fleeces) | 2,707 | " " | 2.9 |
| 58/56s sort | 1,694 | " " | 1.8 |
| 50/48s (fleeces) | 1,265 | " " | 1.4 |
| 40/50s Skirts (from above sorts) | 807 | " " | .9 |
| Grey fleeces | 75 | Off-sort | .1 |
| Grey sort | 31 | " " | .0 |
| Stained | 1,018 | " " | 1.1 |
| Tags | 67 | " " | .1 |
| Strings | 255 | Discarded | .3 |
| Total | 92,030* | | 100.0 |

*Net weight of wool at original Wyoming shipping point, 91.013 lbs.

Combing — were combed into top, noil, and wastes.

These two lots were processed on French combs as directed by the agency which handled the clip for the wool grower. This was done, according to the handler, to (a) "obtain minimum noilage, (b) process the wool in a dry state (without adding oil) so that the color of the tops would not be impaired if they had to be stored for any length of time, and (c) because at that time (August 1951), manufacturers seemed to be increasing their demand for dry-combed tops."

The combing reports are summarized in Table 2.

Significant facts in these data follow:

(a) The mill shrinkage of each lot (67.09% for Fine Staple; 71.00% for Fine French Combing) is comparatively high. This normally would indicate that these high-shrinking (low-yielding) lots were increased in value by processing. Also, in the grease state these wools were very dark in color so that their appearance was unattractive and they would be discounted by prospective buyers, as had been evident on sale of this clip in the grease state in previous years.

(b) In percentage of clean weight of products the amounts of top produced were comparatively high, being 87.08 percent for the Fine Staple sort and 84.50 percent for the Fine French Combing sort.

(c) The noilages were much lower than expected. Noilages obtained,

**TABLE 2—Combing of Fine Crossbred wool**

| | Fine Staple *(Percentage of clean-wool product)* | Fine French Combing *(Percentage of clean-wool product)* |
|---|---|---|
| Top (15% Regain) | 87.08 | 84.49 |
| Noil | 6.11 | 8.15 |
| Card wastes, burr wastes | 4.82 | 5.11 |
| Comb waste, bits, etc. | 1.99 | 2.25 |
| Total | 100.00 | 100.00 |
| Top from clean wool | 87.08 | 84.50 |
| Noil on top-and-noil | 6.55 | 8.79 |
| Mill shrinkage (top, noil, and wastes to grease wool) | 67.09 | 71.00 |

measured as Noil on Top-and-Noil, a trade measure, were 6.55 percent for the Fine Staple sort and 8.79 percent for the Fine French Combing sort. These data are at variance with wool-trade assertions concerning Wyoming wools, namely, that Wyoming wools could be expected to "noil" between 15 and 20 percent in Noble Combing and only slightly less in French Combing. Thus these two lots definitely were exceptions to the rule.

(d) Although the various carding and combing wastes seemed to be comparatively low in each category, the quantities might have been still further reduced.

3. COSTS OF PROCESSING AND MARKETING.

The charges made against the clip follow:

**Sorting:** 2c per pound, grease basis.

**Combing:** 25.5c per pound to top, plus 1c per pound on half the percentage of noil.

**Handling charges** (including supervision of processing, and selling): 2.75c per pound, grease basis.

**Trucking:** 0.1 of a cent to 0.4 of a cent per 100 lbs., grease basis.

**Storage:** for grease wool, 20c per bag per month and for processed products, 20c.

**Freight:** 2.38c per pound, grease basis.

**Discount:** 0.5 of 1% selling discount on tops, 1% selling discount on noils and wastes.

The unit costs for processing and marketing this clip based upon the data listed above are:

| | |
|---|---|
| Cost per pound, grease basis, **for processing** | 8.91c |
| Cost per pound, grease basis, **for marketing** | 7.37c |
| Cost per pound, grease basis, **for handler's supervision and selling commission** | 2.72c |
| Total cost for processing and marketiing, per pound, grease basis | 19.00c |
| Cost of processing per pound of top produced | 37.99c |
| Handler's charge per pound of top produced | 11.59c |

The comparatively high processing cost of 37.99c per pound of top is due mainly to the relatively high shrinkages of the grease-wool lots (67.09% and 71.00%).

In items of cost per unit of top the handler's charge of 11.59c per pound seems excessive. In actual commercial practice this cost could be somewhat reduced.

4. SALE VALUES OF PRODUCTS.

The values realized by the handler for the processed and unprocessed products are listed in Table 3:

**TABLE 3—Selling values of processed wools, minor sorts, and off-sorts**

| Description | Gross value per pound | As percentage of top price of $2.15 per pound |
|---|---|---|
| (a) Processed products: | | |
| Top (Fine Staple) | $2.15 | -- |
| Top (Fine French comb) | 2.10 | 98 |
| Noils | 1.05 | 49 |
| Comb waste | 0.17 | 8 |
| Card waste | 0.60 | 28 |
| Burr waste | 0.13 | 6 |
| Card strips | 0.15 | 7 |
| (b) Minor sorts (sold in grease): | | |
| 62/60s Matchings | 0.45 | -- |
| 58/56s Matchings | 0.46 | -- |
| 58/56s Fleece | 0.47 | -- |
| 50/48s Fleece | 0.47 | -- |
| (c) Off-sorts (sold in grease): | | |
| 40/50s Skirts | 0.45 | -- |
| Grey Matchings | 0.44 | -- |
| Grey Fleece | 0.44 | -- |
| Stained | 0.43 | -- |
| Tags | 0.15 | -- |

It will be seen that:

(a) The price of 105c per pound for noils is comparatively low based upon top and noil prices, amounting to only 49 percent of the value of the top (Fine Staple lot).

(b) Card waste brought 60c a pound on the market and comb waste realized only 17c.

(c) Burr waste and card strippings brought 13c and 15c a pound respectively; the card strippings should have realized much more.

5. DISCUSSION.

The main purpose in processing this clip, from the owner's standpoint, was to overcome the factor of dark, unsightly color in the grease wool. Combined with the heavy condition of the wool, this dark color for many years had caused prospective buyers to estimate abnormally high shrinkages for the clip. Consequently, this clip was always bought for one of the lowest prices in the area. However, after processing the wool the color of the top and noil was very good, being bright and even, and thus the owner's objective was achieved.

However, from the economic standpoint this venture was a failure. The net value realized for the processed products, plus the returns from the sale of the minor grades and off-sorts, was only 38.58c per pound, grease basis.

There is no doubt that the handling and processing of this clip could have been more efficient. This willl be apparent to the textile specialist when methods and results in the following experiments are considered.

Thus the main value derived from this investigation lay in the technical processing data. The knowledge gained by this work was of value to the investigators in subsequent experiments involving processing of similar grease wools from Wyoming.

## Experiment No. A2

To accumulate data concerning the processing potential of Wyoming grease wools, it was decided to select six representative lots of fine and medium crossbred range wools and to scour, card, and comb these according to accepted commercial practice that was somewhat in question in Experiment No. A1.

To this end a graded line amounting to 5,000 lbs. of grease wool was obtained from each of six Southern Wyoming clips, making a total weight of approximately 30,000 lbs. These six commercially graded lines, that could be termed fairly representative of the wools grown in this area, comprised 2 lines of Fine

Staple/Good French Combing, 2 lines of 1/2 blood Staple, and 2 lines of 3/8 blood Staple.

Upon arrival at the commercial topmaking plant the lots were prepared further by sorting, then they were scoured, carded, and combed on standard commercial wool-processing machines. Everything that was done to these wools was in accordance with customary practice.

The mill sorting reports in condensed form are given in Table 4.

Points of interest follow:

(a) The two Fine-wool lots differed markedly in amounts of sorts. Lot 788 had 66.3 percent by weight of 64s Staple and Good French Combing, and Lot 789 had only 52.6 percent by weight; Lot 788 had only 21.9 percent of 64s average F.C., but Lot 789 had 39.0 percent.

(b) The two major sorts of Lots 788 and 789 comprised respectively 88.2 percent and 91.6 percent of the entire lots. Lot 788 had a comparatively high percentage (4.8) of the Fine and Medium pieces; this lowered the amounts of the major sorts.

(c) The 1/2 blood lots (790 and 791) also differed greatly in amounts

**TABLE 4—Sorting report for six experimental lots (Numbers 788 to 793)**
**(Percentages by weight)**

| Quality sort | Lot 788 Fine S. F. C. | Lot 789 Fine S. & F. C. | Lot 790 1/2 blood S. | Lot 791 1/2 blood S. | Lot 792 3/8 blood S. | Lot 793 3/8 blood S. |
|---|---|---|---|---|---|---|
| 64s S. & Good F. C. | 66.3 | 52.6 | ---- | ---- | ---- | ---- |
| 64s Avg F. C. | 21.9 | 39.0 | ---- | ---- | ---- | ---- |
| 60s S. & Good F. C. | ---- | ---- | 59.9 | 42.9 | ---- | ---- |
| 60s Avg. F. C. | ---- | ---- | 31.9 | 52.7 | ---- | ---- |
| 60s Staple | 3.0 | 3.3 | ---- | ---- | 15.4 | ---- |
| 56s Staple | 0.1 | ---- | 3.6 | 1.9 | 76.8 | 88.3 |
| 50s Staple | ---- | 0.1 | ---- | 0.1 | 3.1 | 8.1 |
| 46s Staple | ---- | ---- | ---- | ---- | 0.3 | 0.9 |
| Pieces (F. & Med.) | 4.8 | 1.3 | 0.7 | ---- | 0.4 | 0.4 |
| Grey, paint, stained, tags and black | 3.9 | 3.7 | 3.9 | 2.4 | 4.0 | 2.3 |
| | 100.0 | 100.0 | 100.0 | 100.0 | 100.00 | 100.00 |

of major sorts, there being 59.9 percent of 60s Staple and Good French Combing in one and only 42.9 percent in the other. Lot 790 had only 31.9 percent of 60s average French Combing, but Lot 791 had 52.7 percent.

(d) Contrasting Lots 792 and 793, that were graded 3/8 blood Staple, the sorting report shows that Lot 792 contained 15.4 percent of 60s Staple wool and 76.8 percent of 56s Staple, while Lot 793 had no 60s Staple and had 88.3 percent of 56s Staple. Also Lot 793 had 8.1 percent of 50s Staple while Lot 792 had only 3.1 percent.

From this analysis it can be concluded that, although each of the 3 paired lots was graded alike according to commercial practice, there were distinct qualitative differences between the quality sorts derived from each lot, as determined by mill sorting compared with commercial grading. Part of this difference is due to the fact that mill sorting is "narrower" than commercial grading, because in sorting the fleece is divided, whereas in grading the fleece is judged as a unit.

This could be attributed to the idiosyncrasies of the respective graders, to the specificity of trade requirements, and to small differences in crimp and character displayed by the wools, leading perhaps to small deviations in subjective judgment of quality. A measure of the actual differences in fiber diameter between major sorts of the five lots is found in Table 5.

## 1. CARDING

Throughout these experiments, samples for measurement were drawn from each lot at different stages of processing. Ten 3-ft. lengths of card sliver and of top were drawn at spaced intervals throughout the respective stages. Noils were sampled by taking pinches at intervals and forming composite samples. Standard methods of measurement

**TABLE 5—Fiber diameter of card-sliver samples from 6 lots**

| Lot number and commercial grade | Fiber diameter (microns) and spinning counts of major sorts | |
|---|---|---|
| | Staple and French Combing | Average French Combing |
| 788 Fine | 21.67 (64s) | 21.75 (64s) |
| 789 Fine | 22.40 (64s) | 22.17 (64s) |
| 790 1/2 blood | 25.42 (60s) | 25.75 (58s) |
| 791 1/2 blood | 23.83 (62s) | 24.42 (60s) |
| 792 3/8 blood | 26.83 (58s) | 24.92 (60s) |
| 793 3/8 blood | 27.83 (56s) | ---- ---- |

for fiber diameter and fiber length were used (A.S.T.M. Designations D472-55T: D519-55T).

The data in Table 5 contain several contrasts as follow:

(a) The two Fine lots measured 64s in fiber diameter both in the Staple lines and in the French Combing lines. However, Lot 789 had a slightly larger average fiber diameter than had Lot 788 (22.40 microns against 21.67 microns for the Staple sorts, and 22.17 microns against 21.75 microns for the French Combing sorts).

(b) The lots graded 1/2 blood differed markedly in fiber diameter, the 1/2 Staple sort of Lot 790 measuring 25.42 microns (60s) in contrast to the fiber diameter of 23.83 microns (62s) for Lot 791; likewise the French Combing sort fibers of Lot 790 measured 25.75 microns (58s) in contrast to the same sort made from Lot 791 that measured 24.42 microns (60s).

(c) The two 3/8 blood lots also differed in average fiber diameter, being 26.83 microns (58s) for the Staple sort of Lot 792 as against 27.83 microns (56s) for the Staple sort of Lot 793. These differences indicate that between lots of the same grade, variations in fiber diameter exist. This in turn means that there were theoretical value differences between lots of the same grade, although in actual buying of these lots in the field the prices paid (clean basis) probably would have been the same at any given market-price level.

2. COMBING

The main sorts derived from the Fine lots were combed on French Combs and the main sorts from the 1/2 blood and 3/8 blood lots were processed on Noble Combs.

The summarized combing reports are given in Table 6 and 7. Points of interest follow:

(a) Many similarities between the processing performances of lots of like quality can be found in these data (Table 6). Fine Staple of Lot 788 combed 84.67 percent top and Lot 789 combed 84.69 percent top. Staple 60s combed 84.93 percent top in Lot 788 and 83.75 percent top in Lot 789. Staple 56s combed 84.81 percent top in Lot 790 and 84.46 percent top in Lot 791. However, there are also several significant performance differences in these data (Table 6). For instance, the amount of top derived from 60s average French Combing of Lot 790 was 86.99 percent, and the top from this sort in Lot 791 was only 80.32 percent, the resulting noil on top and noil being 10.68 percent in Lot 790 and 15.17 percent for Lot 791. Again, the top derived from the 56s Staple sort of Lot 792 is 89.65 percent and from the same quality of Lot 793 the top obtained amounted to 92.39 percent. Other similarities and differences can be seen.

(b) The amounts (percentages) of noil in the various lots are comparatively low, except the 14.36

**TABLE 6—Combing reports for the 6 lots**

**(Approximate percentages of clean-wool product from scoured wool)**

| | Fine Staple *(French Combed)*** | Fine French Combing *(French Combed)*** | 60s Staple *(French Combed)*** |
|---|---|---|---|
| Lot 788 | | | |
| Top (15% R.* and oil) | 84.67 | 79.42 | 84.93 |
| Noil | 10.05 | 12.84 | 9.60 |
| Wastes | 5.74 | 8.20 | 6.85 |
| Top from clean wool | 84.67 | 79.42 | 84.93 |
| Noil on top-and-noil | 10.61 | 13.92 | 10.16 |
| Lot 789 | | | |
| Top (15% R.* and oil) | 84.69 | 81.79 | 83.75 |
| Noil | 8.99 | 10.86 | 9.98 |
| Wastes | 9.36 | 7.72 | 7.49 |
| Top from clean wool | 84.69 | 81.79 | 83.75 |
| Noil on top-and-noil | 9.60 | 11.72 | 10.65 |

| | 60s S. & Good F. C. *(Noble Combed)* | 60s Avg. F. C. *(Noble Combed)* | 56s Staple *(Noble Combed)* |
|---|---|---|---|
| Lot 790 | | | |
| Top (15% R.* and oil) | 88.73 | 86.99 | 84.81 |
| Noil | 9.00 | 10.40 | 10.13 |
| Wastes | 4.82 | 5.18 | 8.72 |
| Top from clean wool | 88.73 | 86.99 | 84.81 |
| Noil on top-and-noil | 9.21 | 10.68 | 10.67 |
| Lot 791 | | | |
| Top (15% R.* and oil) | 87.90 | 80.32 | 84.46 |
| Noil | 9.97 | 14.36 | 11.10 |
| Wastes | 4.77 | 7.74 | 6.66 |
| Top from clean wool | 87.90 | 80.32 | 84.46 |
| Noil on top-and-noil | 10.19 | 15.17 | 11.62 |

| | 60s Staple *(Noble Combed)* | 56s Staple *(Noble Combed)* |
|---|---|---|
| Lot 792 | | |
| Top (15% R.* and oil) | 85.89 | 89.65 |
| Noil | 9.76 | 7.58 |
| Wastes | 6.25 | 5.39 |
| Top from clean wool | 85.89 | 89.65 |
| Noil on top-and-noil | 10.20 | 7.80 |

| | 56s Staple *(Noble Combed)* | 50s Staple *(Noble Combed)* |
|---|---|---|
| Lot 793 | | |
| Top (15% R.* and oil) | 92.46 | 92.39 |
| Noil | 6.58 | 7.06 |
| Wastes | 3.73 | 3.27 |
| Top from clean wool | 92.46 | 92.39 |
| Noil on top-and-noil | 6.64 | 7.10 |

*R., short for Regain, is the amount of moisture in the wool expressed as a percentage of the dry weight of wool.

**Combed dry, without oil.

percent of noil from scoured wool found in Lot 791, French Combing.

(c) The percentages of wastes also seem comparatively low.

(d) The amounts of top derived appear to increase and the amounts of noil to decrease with increase in fiber diameter in wools of Staple length.

(e) The shorter wools decrease in amounts of top derived and increase in noil contents compared with Staple wools within their respective grades.

**TABLE 7—Summary of combing reports for the 6 lots**
**(Approximate percentages of clean-wool product from scoured wool)**

| | Top *(percent)* | Noil *(percent)* | Noil on top and noil *(percent)* | Wastes *(percent)* |
|---|---|---|---|---|
| Fine Staple and Good French Combing (64s) | 84.68 | 9.52 | 10.11 | 7.55 |
| Fine Average French Combing (64s) | 80.61 | 11.85 | 12.82 | 7.96 |
| ½ blood Staple (60s) | 85.41 | 9.68 | 10.18 | 6.55 |
| ½ blood Staple and Good French Combing (60s) | 88.32 | 9.49 | 9.70 | 4.80 |
| ½ blood French Combing (60s) | 83.66 | 12.38 | 12.93 | 6.46 |
| ⅜ blood Staple (56s) | 87.85 | 8.85 | 9.18 | 6.13 |
| ¼ blood Staple (50s) | 92.39 | 7.06 | 7.10 | 3.27 |

## FIBER-DIAMETER MEASUREMENT OF THE PROCESSED PRODUCTS

The average fiber diameter for the various card slivers and their respective tops and noils were determined by using the micronaire, a compressed-air device used in wool testing. These data are given in Table 8.

Quality numbers (in brackets) were assessed based upon the standards for wool top prescribed by the American Society for Testing Materials (A.S.T.M. Designation D472-47T. 1947). The quality numbers given for the wools in the grease state are the comber's designations based upon visual estimates (column 1).

Facts of interest follow:

(a) In 7 cases out of 10 the average fiber diameter of the card sliver is greater than the fiber diameter of the top. This seems very strange; it might cause the data to be discredited because it is illogical to conceive that top could possibly be of smaller fiber diameter than the card sliver from which it was combed.

(b) The noils are finer in fiber diameter than both their respective card slivers and tops.

(c) In 5 cases out of 11 the tops are finer than their respective commercial quality (subjective) designations in the grease form.

**TABLE 8—Fiber diameter of processed products in microns**

| Commercial designation | Card sliver | Top | Noil |
|---|---|---|---|
| **Lot 788** | | | |
| (a) Fine Staple and Good French Combing (64s) | 21.67 (64s) | 21.75 (64s) | 20.58 (70s) |
| (b) Fine Average French Combing (64s) | 21.75 (64s) | 21.67 (64s) | 20.42 (70s) |
| **Lot 789** | | | |
| (a) Fine Staple and Good French Combing (64s) | 22.40 (64s) | 22.25 (64s) | 20.17 (70s) |
| (b) Fine Average French Combing (64s) | 22.17 (64s) | 22.25 (64s) | 20.92 (70s) |
| **Lot 790** | | | |
| (a) ½ blood Staple (60s) | 25.42 (58s) | 24.75 (60s) | 21.17 (64s) |
| (b) ½ blood Average French Combing (60s) | 25.75 (58s) | 25.75 (58s) | 21.58 (64s) |
| **Lot 791** | | | |
| (a) ½ blood Staple (60s) | 23.83 (60s) | 23.33 (62s) | 21.08 (64s) |
| (b) ½ blood Average French Combing (60s) | 24.42 (60s) | 25.00 (60s) | 21.33 (64s) |
| **Lot 792** | | | |
| (a) ⅜ blood Staple (56s) | 26.83 (56s) | 26.67 (58s) | 22.50 (64s) |
| (b) ½ blood Staple (60s) | 24.92 (60s) | 23.67 (62s) | 21.25 (64s) |
| **Lot 793** | | | |
| ⅜ blood Staple (56s) | 27.83 (56s) | 26.83 (58s) | 22.42 (64s) |

## PROCESSING COSTS

The costs of processing, comprising sorting, scouring, and combing but excluding freight and grading, were found to vary between 10.21c and 11.66c per pound of grease wool with an average cost of 10.94c.

Processing costs varied with the yield of clean wool, the amount of top and noil produced, and the specific grade involved.

## PROFITS RECEIVED FROM PROCESSING

The gross prices received by the wool growers from sale of the processed products per pound are as follow:

| | |
|---|---|
| Top | from $1.40 for 1/4 blood (50s) to $2.10 for Fine (64s). |
| Noil | from $ .90 for 1/4 blood (50s) to $1.00 for Fine (64s). |
| Card Waste, dusted | from $ .05 for doffer waste to $.50 for card waste (64s). |
| Comb Waste | from $ .80 for 1/4 blood (50s) to $1.00 for Fine (64s). |
| Scoured off-sorts | from $1.00 for Low 1/4 blood (46s) to $1.20 for 3/8 blood (56s). |
| Scoured paint sorts | $.50 for 64s to 56s. |

The six lines were shipped from Wyoming to Texas on May 13, 1952. All processed products from the 6 lines were sold between June 14 and July 19, 1952.

A detailed estimation of the value of each line in the grease was made based upon average prices prevailing on the Boston market for the various main grades and off-sorts during the period from the time of shipping to the plant to the date upon which the final returns were received.

The average current marketing cost for selling wools from this area was deducted from the gross grease prices calculated on the clean-basis Boston prices. From the processed wools the freight from Wyoming to the plant and the grading cost were deducted.

The theoretical net values the wool grower would have received by selling the wool in the grease at the shipping point, the actual net prices received by the wool growers from processing before sale, and the theoretical net profit from processing before sale are shown in Table 9.

*The average net profit due to processing the wools before sale was 3.70c per pound of wool on the grease basis.*

A second method for calculating profits due to processing was employed.

It is logical to assume that grease-wool prices prevailing in this area for similar crossbred wools would be indicative of the values of the processed lines had they been sold in the grease at the shipping point.

During May, June, and July 1952, eight large clips were sold in the

Rawlins area for prices ranging from 46.7c per pound to 55.00c grease basis. The average net price received by these wool growers was 50.08c. Seven of these clips contained various quantities of yearling wools; one clip did not contain yearling wool.

The average net grease prices received by the wool growers for the processed lines was **55.33c per pound, grease basis.**

Thus, the average net profit from processing the wools before sale, as calculated by this method, was 5.25c per pound, grease basis.

During the period elapsing between May 13, when the wools were shipped from Wyoming, and July 19, when all the processed products had been sold, the Boston market-price levels for grease wools, wool tops, noils, and wastes remained almost constant with gradual gains of less than 3 percent in some items.

**TABLE 9—Comparative prices for wools sold in the grease and as processed products**

| Line number and grade | Theoretical net value by grade, cents per pound | Actual net prices, grease basis, by processing, cents per pound | Net profit from processing, grease basis, cents per pound |
|---|---|---|---|
| 788 Fine | 48.89 | 53.38 | 4.49 |
| 789 Fine | 51.15 | 56.52 | 5.37 |
| 790 ½ blood | 54.68 | 60.37 | 5.69 |
| 791 ½ blood | 52.37 | 57.25 | 4.88 |
| 792 ⅜ blood | 51.36 | 52.15 | 0.79 |
| 793 ⅜ blood | 51.30 | 52.30 | 1.00 |
| Averages | 51.63 | 55.33 | 3.70 |

## Experiment No. A3

Six lots of 1/2 blood wool, each weighing approximately 10,000 lbs., from six range clips in Southern Wyoming, were chosen. The total net weight of this wool was 61,269 lbs.

These wools were from clips graded by commercial graders at the shearing pen or in the local warehouse, except one original-bag lot (No. 3194), which was taken from the clip at spaced intervals during shearing of the ewe wool and was not graded. Each of the other five clips was graded by a different grader.

These lots were shipped from Wyoming in June 1953 to a wool-processing plant in the Boston area. Between September 8 and October 3 they were processed into top and noil, and wastes.

**TABLE 10—Sorting reports of ½ blood lots**

| Lot | Net weight *(pounds)* | ½ blood *(percent)* | ⅜ blood *(percent)* | String *(percent)* |
|---|---|---|---|---|
| Lot 3193 Graded | 10,156 | 97.84 | 1.84 | 0.32 |
| Lot 3194 Original Bag | 10,289 | 96.31 | 3.35 | 0.34 |
| Lot 3202 Graded | 10,034 | 97.85 | 1.94 | 0.21 |
| Lot 3206 Graded | 10,194 | 94.87 | 4.92 | 0.21 |
| Lot 3207 Graded | 10,174 | 95.97 | 3.82 | 0.21 |
| Lot 3208 Graded | 10,422 | 97.42 | 2.37 | 0.21 |
| Averages | | 96.71 | 3.04 | 0.25 |

Lot 3261, 58s to 48s sorts from ½ blood lots (the 3.04 % of ⅜ blood) = 1,865 pounds.

The mill sorting reports have been compiled in Table 10.

During sorting at the mill only coarse-fibered breech wool and a few off-grade fleeces, too coarse for the main grade, were taken out. These coarse wools (58s to 48s) from each lot were combined into one Lot, No. 3261, and then processed. In quantity, this coarse sort from each lot varied from 1.84 to 4.92 percent with an average of 3.04 percent for the six lots.

The fleece string in each lot was, of course, treated as a component of shrinkage. String varied from 0.21 to 0.34 percent by lot with an average of 0.25 percent for the six lots.

The remarkable thing about these sorting data is that there is such a high proportion of main sort in every lot, varying from 94.87 to 97.85 percent with an average of 96.71 percent.

Table 11 contains a summary of the combing reports furnished by the mill. All lots were Noble combed.

Points to be noted are:

(a) The wide variation in condition between these lots in the grease form is demonstrated by the range in shrinkage of 11.2 percent (67.4% to 56.2%).

(b) There is a high degree of uniformity in these lots as exemplified by the range in yield of top, being only 2.1 percent (Lots 3193, 3194), with an average yield of 86.3 percent.

(c) Similarly, the noil contents are very uniform in proportion, varying from only 9.5 to 11.7 percent (range of 2.2%) with an average noil content of 10.6 percent. The noil on top-and-noil, another way of expressing noilage, varied from 9.8 to 12.1 percent with an average value of 10.9 percent.

(d) The amounts of waste are comparatively low, averaging 1.3 percent for card waste and 1.8 percent for burr waste.

(e) The last column contains data for Lot 3261, the breech wool and

coarse wool sorted from the six half-blood lots. For this lot the yield of top was comparatively low (84.5%), and the amounts of waste were high, being 2.6 percent for each of the card waste and burr waste. The amount of noil (10.3%) was normal.

## MEASUREMENTS OF GREASE WOOL AND PRODUCTS

Single staples of the grease wool were drawn at random during sorting of the lots in the mill.

Samples of the scoured wools were drawn at random as the wool was discharged from the dryer.

Samples were drawn of tops, noils, and wastes as follows:

10 samples of top each 4 ft. long at intervals.

Grab samples at intervals from noils, wastes, weighing **in toto** approximately one pound.

Table 12 shows the measurements of the three series of samples.

Several points of interest are noted in the data for the six main lots as follow:

(a) Staple lengths of the grease wool are closely related to the fiber lengths of the respective tops (r= + .58 for these data. Johnston **et al.** (1) reported an r= +.88 for this relationship).

(b) Fiber diameter of the scoured wool, on an average, is less than that of the tops by 0.5 micron.

(c) The top measurements proved the accuracy of the graders' classing because the six lots all yielded 1/2 blood top (58s, 60s).

(d) The variability (C.V.) of fiber length in top is comparatively high high for all lots, being, on an aver-

**TABLE 11—Mill combing reports on ½ blood lots**

| | Lot 3193 ½ bld. sort | Lot 3194 ½ bld. sort | Lot 3202 ½ bld. sort | Lot 3206 ½ bld. sort | Lot 3207 ½ bld. sort | Lot 3208 ½ bld. sort | Avgs. 6 lots ½ bld. sort | Lot 3261 58s-48s combined low sorts |
|---|---|---|---|---|---|---|---|---|
| Sorted weight (Pounds) | 9,937 | 9,909 | 9,818 | 9,671 | 9,764 | 10,173 | ----- | 1,865 |
| Shrinkage (%) | 56.2 | 56.5 | 61.0 | 60.1 | 63.2 | 67.4 | 60.7 | 62.6 |
| Processed products as percentages of total products: | | | | | | | | |
| Top (15% R. and 3% oil) | 85.3 | 87.4 | 85.9 | 86.1 | 86.2 | 86.8 | 86.3 | 84.5 |
| Noil | 11.7 | 9.5 | 10.9 | 10.5 | 10.3 | 10.8 | 10.6 | 10.3 |
| Card waste | 1.1 | 0.9 | 1.3 | 1.9 | 1.5 | 1.3 | 1.3 | 2.6 |
| Burr waste | 1.9 | 2.2 | 1.9 | 1.5 | 2.0 | 1.1 | 1.8 | 2.6 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Noil on top-and-noil (%) | 12.1 | 9.8 | 11.3 | 10.9 | 10.7 | 11.1 | 10.9 | 10.9 |
| Oil in top (%) | 3.2 | 3.5 | 3.4 | 3.3 | 3.3 | .3.2 | 3.3 | 3.1 |

**TABLE 12—Measurements of grease and scoured ½ blood lots and the tops derived from them**

| Lot number | Grease wool | | Scoured wool | | | | Top | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Average staple length *(inches)* | Staple length C.V. *(percent)* | Average fiber diameter *(microns)* | Fiber diameter C.V. *(percent)* | Average fiber diameter *(microns)* | Fiber diameter C.V. *(percent)* | Spinning Count | Average fiber length *(inches)* | Fiber length C.V. *(percent)* | Proportion of fibers under 2" long *(percent)* |
| 3193 | 2.6 | 21.9 | 24.1 | 25.3 | 24.9 | 25.7 | 60s | 2.7 | 35.5 | 22.0 |
| 3194 | 2.9 | 19.8 | 26.0 | 24.7 | 26.2 | 24.5 | 58s | 3.0 | 37.7 | 20.6 |
| 3202 | 2.7 | 14.6 | 24.7 | 24.9 | 25.3 | 23.3 | 60s | 2.7 | 35.8 | 21.8 |
| 3206 | 2.8 | 14.5 | 25.8 | 24.5 | 26.2 | 23.5 | 58s | 2.7 | 36.4 | 24.6 |
| 3207 | 2.6 | 20.2 | 23.1 | 25.0 | 24.1 | 23.3 | 60s | 2.8 | 41.8 | 26.8 |
| 3208 | 2.7 | 21.7 | 24.2 | 22.9 | 24.6 | 23.2 | 60s | 2.7 | 37.6 | 25.0 |
| Averages of 6 lots | 2.7 | 18.8 | 24.7 | 24.5 | 25.2 | 23.9 | --- | 2.8 | 37.5 | 23.5 |
| 3261 (Composite of coarse sorts) | 2.7 | 21.7 | 27.9 | 30.6 | 29.2 | 31.5 | 54s | 2.9 | 36.4 | 20.2 |

**TABLE 13—Incidence of defect fibers in 7 lots of top**

| Lot number | Neps *(number per ½ ounce)* | Black fibers *(number per ½ ounce)* | Kemps *(number per ½ ounce)* | Vegetable matter *(pieces per ½ ounce)* |
|---|---|---|---|---|
| 3193 | 63 | 5 | 3 | 6 |
| 3194 | 60 | 3 | 3 | 7 |
| 3202 | 89 | 0 | 1 | 4 |
| 3206 | 94 | 2 | 1 | 6 |
| 3207 | 101 | 5 | 2 | 6 |
| 3208 | 84 | 2 | 1 | 3 |
| Average | 81.8 | 2.8 | 1.8 | 5.3 |
| 3261 | 43 | 72 | 2 | 4 |

age, 37.5 percent and varying from 35.5 to 41.8 percent.

(e) The proportions of fibers in top under 2 in. long vary from 20.6 to 26.8 percent with an average of 23.5 percent.

(f) Lot 3261 yielded products that were slightly greater in average fiber diameter than the main lots. This composite lot of coarse wools from the other six lots was found to be of 54s quality.

Defects in top adversely affect the selling value. Neps (tangled fiber clumps), black fibers, kemps, and vegetable fibers are found in tops, and the degree to which they are present influences the value of this product.

A study was made of triplicate 1/2 ounce samples of these fibers in the seven lots combed in this experiment. The results are found in Table 13.

The following points are evident:

(a) The average number of neps per 1/2 ounce of top varied from 60 to 101 with an average 81.8 for the 1/2 blood wools. These nep counts were very high compared with the Wool Top Exchange specifications for Noble combed top, which are: (1) for 60s top an average of 39 neps per 1/2 ounce and a range of 30 to 50 per 1/2 ounce, and (2) for 58s top an average of 37 neps per 1/2 ounce and a range of from 25 to 45 per 1/2 ounce. By comparing the nep counts in Table 13 with these specifications the counts are in excess of specified maximum limits by an average of 69.3 percent. These comparisons seem to indicate that the six 1/2 blood clots contained an excess of neps, many more than are accepted as normal. In the case of Lot 3261 only 43 neps per 1/2 ounce were found.

(b) Black fibers in the top varied from zero to 5 per 1/2 ounce with

an average of 2.8. In the coarse top lot (3261), 72 black fibers per 1/2 ounce were found.

(c) Kemps include not only true kemp fibers but also coarse, heavily-medullated, opaque fibers, most of which are comparatively short. In quantity these were found to be from 1 to 3 per 1/2 ounce of top with an average number of 1.8 per 1/2 ounce. Lot 3261 contained only 2 kemps per 1/2 ounce of top.

(d) Small particles of vegetable matter were found to vary in number from 3 to 7 per 1/2 ounce for the 7 lots.

The quality of all products, in terms of fiber diameter, was obtained in order to measure value differences.

## SELLING THE PROCESSED PRODUCTS

After considering the character and the certified quality of each lot of top, blending by groups was performed in order to gain selling volume. This was necessary because the weight of top in a contract lot must lie between 4,800 and 5,200 lbs.

Blending was done as shown in Table 14.

By blending the various lots of top together, four contract lots were made. These were sold on the wool-top exchange on May 25, 1954, for July delivery. Two contracts were sold for $2.025 a pound, one contract sold for $2.021 a pound, and one contract realized $2.075.

There was a 1 percent deduction (1.99 cents a pound) for combing made against the Lot of 62s top. The wool-exchange appraisers did not specify the reason for this deduction. They merely indicated that the general character of the top did not warrant the assessment of full value.

**TABLE 14—Blending tops of similar dimensions**

| Double grilling of 60s | | | Triple grilling of 62s | | |
|---|---|---|---|---|---|
| | Combined conditioned weight *(pounds)* | Certifiied quality | | Combined conditioned weight *(pounds)* | Certified quality |
| Lot 3193 | 3685 | 60s | Lot 3207 | 1258 | 62s |
| Lot 3194 | 3739 | 60s | Lot 3208 | 2841 | 62s |
| Lot 3202 | 3260 | 60s | Lot 3197* | 536 | 62s |
| Lot 3206 | 3284 | 60s | Lot 3198* | 516 | 62s |
| Lot 3207 | 1506 | 62s | | | |
| Total | 15474 | | Total | 5151 | |

Final weights sold — 15,243 pounds (15% moisture Regain and 3% oil)

Final weights sold — 5,144 pounds

*Lots 3197 and 3198 were other experimental wools not part of this experiment, used only to make up the amount of 62s top for 1 contract.

Sales of off-sorts and byproducts were made at the following gross prices:

| | |
|---|---|
| Comb waste | 40 cents per pound |
| Oily waste | 40 cents per pound |
| Card waste (dusted) | 40 cents per pound |
| Burr waste | 20 cents per pound |
| Card strippings | 40 cents per pound |
| Noils (60s and 62s) | 90 cents per pound |
| 50s top | $1.40 cents per pound |
| 50s noil | 90 cents per pound |

PROCESSING AND MARKETING COSTS

The total marketing costs for preparation, transportation, processing, and selling are as follow:

| | |
|---|---|
| Grading at shearing pens | 0.54c to 0.75c per pound, grease basis. |
| Grading at warehouse | 1.50c per pound, grease basis. |
| Freight | 2.84c to 2.89c per pound, grease basis. |
| Sorting | 1.50c per pound, grease basis. |
| Combing | 20.00c per pound of top plus 1/2c for each 1% noil. |

Selling of products

(1) For top-gilling, transportation, storage, broker's commission, etc. 10.10c to 11.82c per pound of top.

(2) Commission for minor grades, wastes 5c per pound, plus discount of 1% of sale price.

**TABLE 15—Values received by growers for clips and experimental processed lots in cents per pound, grease basis**

| | Lot 3193 | Lot 3202 | Lot 3206 | Lot 3207 | Lot 3208 |
|---|---|---|---|---|---|
| Net return to grower from ½ blood grade in clip | 51.80 | 46.42 | 48.03 | 47.16 | 38.36 |
| Net return to grower from ½ blood processed lot | 52.19 | 46.89 | 47.70 | 45.47 | 40.24 |
| Profit (+) or loss (-) due to processing | +0.39 | +0.47 | -0.33 | -1.69 | +1.88 |

The totals of all costs for preparing, processing, and marketing these wools ranged from 16.0c to 19.8c per pound, grease basis, with an average cost of 17.6c.

## RESULTS FROM PROCESSING EXPERIMENT NO. A3

Comprehensive costs and returns were obtained for all lots in this work with one exception, Lot 3194, the original-bag lot. The investigators were unable to obtain conclusive evidence of sale for the remainder of this clip. Thus, in calculating the returns obtained from sale of these processed wools, this lot was omitted.

On the remaining 5 clips, complete sale data were obtained. Based upon these account sales and the returns from the experimental wools, value comparisons are shown in Table 15.

The net sale values of the processed 1/2 blood lots, compared with the net values of their unprocessed counterparts, ranged from a gain of 1.88c to a loss of 1.69c a pound, grease basis, with an average gain of 0.14c per pound, grease basis, for the processed wools. These favorable results were obtained in spite of the fact that the values of the experimental lots suffered because of their comparatively small size, disadvantageous disposition of wastes, and abnormal handling and selling charges due to their small size. Also, commercial charges for services and processing of these wools were not as low as if the wools had been in larger lots.

To illustrate the influence on price of the factor of size-of-lot, it was found in the course of this work that one very large clip of over 400,000 lbs. of original-bag 1/2 blood wool sold for approximately 57c per pound at the same market price level at which another graded 1/2 blood lot of only 21,000 lbs. was sold for 51.8c net, per pound, to the grower. The tested shrinkage difference between these two lots was only 0.34 percent, other characters of the two lots being very comparable. The price discrimination of approximately 5.2c per pound for the smaller clip appears to be unjustified.

This example illustrates the value factor in the sale of bulk products, versus small quantities, which is extremely difficult to measure, especially with fluctuating market demands and the conditions under which domestic grease wools are marketed.

It is important to note that commercial sorting at the mill resulted in an average of only 3.04 percent by weight being taken out as coarser off-sorts, leaving 96.71 percent by weight in the main sort (Table 10). Fleece strings amounted to an average of 0.25 percent of the weight of the 6 lots.

From this instance as well as evidence from other processing tests, it appears that intensive sorting is not as widely practiced by the wool-manufacturing industry as it used to be.

There was a range in shrinkage in the 6 lots of 11.2 percent (56.2 to 67.4), a range in yield of top from grease wool of 9.7 percent (27.9 to 37.6), but the range in proportion of top to total processed products from each lot was only 2.1 percent (85.3 to 87.4) (Table 11).

Noil contents (as noil on top-and-noil) averaged 10.9 percent, varying from 9.8 to 12.1 percent. This is a range of only 2.3 percent, which is comparatively small considering the fact that these wools were of varied breeding and that they originated on different types of range.

The relationship of staple length of grease wool to fiber length of resulting top was quite high (r= .61), average staple length of the lots being 2.7 in. and the average fiber length of the top being 2.8 in.; the greatest difference in these two measures in any lot was 0.2 in. (Table 12).

The relationships in fiber diameter of the various forms of wool during processing to the initial scoured form are shown in Table 16.

The top has the largest fiber diameter of all. Both top- and card-sliver fiber diameters are larger than that of scoured wool. Card waste and burr waste are finer than scoured wool. Fiber diameter of noil is the smallest of all products.

It was found that separate lots of top containing either too much fine wool or abnormal quantities of coarse fibers could be made to conform to established standards for tops by blending with them (gilling) certain quantities of other tops having the required characters. The investigators found that this practice was quite common throughout the domestic wool-processing industry, and that no one could state specifically the accepted limits for blending tops because there were no rules defining them.

Average values of products compared with the average selling price for the top as found in this experiment are given in Table 17.

Because of the comparatively small amounts of noils and wastes, these products were devalued by the buyers.

**TABLE 16—Fiber diameters of processed products compared with fiber diameter of initial scoured wool**

| | Fiber diameter *(microns)* | Percent |
|---|---|---|
| Scoured wool | 24.65 | 100.0 |
| Card sliver | 24.79 | 100.6 |
| Card waste | 23.62 | 95.8 |
| Burr waste | 24.43 | 99.1 |
| Top | 25.22 | 102.3 |
| Noil | 21.66 | 87.9 |

**TABLE 17—Prices of processed products compared with the top product**

| Product | Gross price received per pound | Prices as percentages of top price |
|---|---|---|
| Top | $1.91 | 100.0 |
| Noil | .90 | 47.1 |
| Burr waste | .20 | 10.5 |
| All other wastes | .40 | 20.9 |

## DISCUSSION AND RESULTS OF OBJECTIVE B

Objective B. "To determine the feasibility of selling off-sorts and tags in scoured forms."

Generally, wool growers are inclined to disdain the off-sorts and tags of their wool clips, because these inferior wools appear to have less value than wool in the fleece on the market.

While this is true, nevertheless it is well recognized among the wool trade that there is comparatively greater profit, pound for pound, to be made in buying and selling off-sorts than in dealing in wool in the fleece.

To obtain cost data and selling prices of tags and other off-sorts in grease and scoured forms, several experiments were undertaken.

### Experiment No. B1

Nine lots of tags weighing 23,348 lbs. were each divided equally into two parts, one part being left in the grease state and each second portion being scoured.

These tags were from nine flocks of crossbred sheep. All lots contained Fine, Medium, and Coarse wools to varying degrees. No sorting was done to these tags; they were scoured directly from the Original Bags. Cost of scouring was 2.70 cents per pound, grease basis (Table 20). All lots, both grease portions and scoured portions, were sold within a period of 8 weeks during which wool-market prices were comparatively level. The derived data will be found in Table 18 as follow:

**TABLE 18—Tags sold in grease state and scoured state**

| Lot | Weight lbs. | Shrinkage of scoured portion % | Net prices per grease pound received by grower: Sold grease state, cents per lb. | Net prices per grease pound received by grower: Sold scoured, cents per lb. | Gain (+) or loss (-) to grower in cts. per lb., grease basis | Percentage gain (+) or loss (-) over price in grease state |
|---|---|---|---|---|---|---|
| L | 1350 | 68.9 | 8.2 | 24.7 | +16.5 | +201 |
| B | 2165 | 80.7 | 6.3 | 11.7 | + 5.4 | + 86 |
| E | 6664 | 79.2 | 4.3 | 13.0 | + 8.7 | +202 |
| C | 1802 | 71.8 | 11.1 | 21.6 | +10.5 | + 95 |
| A | 3238 | 73.4 | 8.3 | 20.3 | +12.0 | +145 |
| P | 2549 | 74.8 | 12.2 | 17.0 | + 4.8 | + 39 |
| S | 1876 | 73.8 | 8.3 | 19.9 | +11.6 | +140 |
| R | 2015 | 85.8 | 12.0 | 5.7 | - 6.3 | - 52 |
| V | 1689 | 82.0 | 12.0 | 8.8 | - 3.2 | - 27 |
| Averages | | 76.7 | 9.2 | 15.9 | + 6.7 | + 73 |

The range in shrinkage of these tag lots was 16.9 percent (68.9 to 85.8 percent) with an average shrinkage of 76.7 percent. Net grease prices ran from 4.3 to 12.0c with an average of 9.2c per pound. Net prices for tags sold in the scoured state ran from 5.7 to 24.7c per pound, grease basis, with an average of 15.9c per pound. Net values to the wool growers ranged from a loss (-) of 6.3c to a profit (+) of 16.5c per pound with an average profit of 6.7c per pound, grease basis, for these 9 lots.

The two lots (R and V), upon which losses were sustained by the owners because of the comparatively low clean value obtained (90c per pound, scoured basis), were sold on the Boston market by an organization which handles very few scoured wools of any kind, although it sells large volumes of domestic grease wool for numerous wool-marketing organizations. It appears from our work so far that noteworthy differences in efficiency exist between wool-selling agencies. Those who handle their own specialties are able to obtain higher values for the products probably because they are better qualified to judge intrinsic values of these specialty products, and they are in touch with all the manufacturers who use them.

Seven of the nine lots above, both grease and scoured portions, were sold between March 12 and May 14, 1953. During this period market values of these wools were **comparatively level** in spite of the fact that market demands were sporadic. This level-price situation was no doubt due to the Commodity Credit Corporation wool-loan program, which guaranteed prices for domestic wools on the market. Lots R and V were sold on September 8, 1953.

## Experiment No. B2

For comparison, actual market-selling values were derived for several small lots of off-sorts obtained from range-wool clips. Scouring of portions of these off-sorts was done in the University wool plant. These data are contained in Table 19.

The owner of the eye clippings, up to the time of their sale in scoured form, had not obtained an offer of more than 50c per pound, grease basis, for his entire clip of ewe fleeces. The scoured eye clippings returned 57.2c per pound, grease basis, net to him, at which he was amazed because eye clippings are usually thought of as having a very low value.

Also in Table 19 it should be noted that, by scouring half the tags before sale, a profit of 8.7c (13.0 less 4.3c) a pound, grease basis, was made for this grower.

However, the shearing-pen sweepings in this case were not benefited by scouring because 4.3c (26.3 less 22.0c) per pound, grease basis, was lost by scouring.

Based upon the data obtained from these two experiments, the costs and returns that would result from selling Wyoming tags in three different ways were established. In Table 20 the itemized costs and returns to be expected are given for (a) selling tags in grease state on the central market (Boston), (b) scouring tags in Wyoming and selling these scoured tags in Boston, and (c) shipping tags in grease form from Wyoming to Boston, scouring them in Boston, and selling scoured tags in Boston.

**TABLE 19—Tags, shearing-pen sweepings, and eye clippings sold in grease and scoured**

| Lot, class and number | Shrinkage *(percent)* | Net prices received per pound, grease basis: Sold in grease form *(cents per pound)* | Net prices received per pound, grease basis: Sold in scoured form *(cents per pound)* |
|---|---|---|---|
| Tags—Lot E | 79.2 | 4.3 | 13.0 |
| Shearing-pen sweepings | 72.3 | 26.3 | 22.0 |
| Eye clippings | 40.9 | 50.0 | 57.2 |

**TABLE 20—Commercial costs and net profits for selling Wyoming tags in three ways**

| Column 1 | Column 2 | | Column 3 | | Column 4 | |
|---|---|---|---|---|---|---|
| Charges | Sold in grease in Boston cts. per lb., grease basis | | Sold scoured Scoured in Wyoming and shipped scoured cts. per lb., clean basis | | Sold scoured Shipped in grease and scoured in Boston cts. per lb., clean basis | |
| Discount | 1% of selling price | 0.18 | 1% of selling price | 1.07 | 1% of selling price | 1.07 |
| Commission | 1c/pound | 1.00 | 2c/pound | 2.00 | 2c/pound | 2.00 |
| Freight | 2.9c/lb., grease basis | 2.90 | 7c/lb., scoured basis | 7.00 | 2.9c/lb., grease basis | 12.45 |
| Handling | 25c/bag | 0.06 | 40c/bag | 0.40 | 40c/bag | 0.40 |
| Loading & unloading | 35s/100 lbs. | 0.35 | 35c/100 lbs. | 0.35 | 35c/100 lbs. | 0.35 |
| Weighing | 15c/bag | 0.03 | 15c/bag | 0.15 | 15c/bag | 0.15 |
| Storage, 3 months | 10c/100 lbs./month | 0.30 | 26.5c/100 lbs./month | 0.80 | 26.5c/100 lbs./month | 0.80 |
| Sorting | 1.50/pound/grease basis | 1.50 | Same | 6.44 | Same | 6.44 |
| Scouring | 2.70/pound/grease basis | ---- | Same | 11.59 | Same | 11.59 |
| Total cost in cents per pound, grease basis | | 6.32 | | 6.94 | | 8.21 |
| Net price of tags cents/lb., grease basis | | 11.48 | | 17.99 | | 16.72 |
| Profit over grease state sale price | | | | 6.51 cts./lb. grease basis | | 5.24 cts./lb. grease basis |

From these calculations it seems that Wyoming tags will bring more money to the wool grower if sold in the scoured state in bulk (carload lots) on the Boston wool market.

It is estimated that on the Boston market, if grease tags are selling for approximately 11.5c per pound (Col. 2), then scoured tags will sell for 16.7c per pound, grease basis (Col. 4), and therefore the profit by scouring these tags in Boston and selling them in scoured form will be approximately 5.2c per pound, grease basis, above the return received from selling these tags in the grease form.

If the tags in bulk could be sorted and scoured in Wyoming, shipped in the scoured state, and sold on the Boston wool market, then the profit could be increased to 6.5c per pound, grease basis, above the price received for the same tags sold in the grease form.

It should be noted that the freight rate for grease tags in carload lots is 2.9c per pound, which is equivalent to 12.45c per pound of clean wool fiber. The freight rate on scoured tags in carload lots is only 7.0c per pound. Thus, by scouring tags in Wyoming and shipping them **in the scoured form in carload lots,** the wool grower could save 5.45c per pound of scoured wool or the equivalent 1.27c per pound, grease basis.

It is customary for the wool buyer to require the grower to accept a deduction of from 1 to 2 percent by weight from his clip for tags. For this part of his clip the grower receives no return whatsoever, and, in addition to this inequity, he has to pay freight of 2.9c per pound on these tags.

*Factors for improved preparation (broker's recommendations) derived from this tag study:*

(a) The broker who sold the major portions of these tags recommended that, even in small lots, tags should be sorted into Fine, Medium, and Coarse grades before sale or processing for sale.

(b) Clumps and locks of hairy (breech) wool must be carefully picked out from each grade and sold separately.

(c) Presence of clumps and locks of black or gray fiber is a serious defect that lowers considerably the selling values of off-sorts.

The broker stated that on account of these defects "a discount of at least 10c (a pound) would have to be given" and that "several of the lots (off-sorts) had to be discounted, in our opinion, because they were "mixy" in grade containing low (quality) locks, gray, or paint, etc."

It is probable that the buyer of these grease-form and scoured lots used the presence of these defects to depress the price. However, in spite of these faults very good prices were obtained for the scoured tags and eye clippings.

## DISCUSSION AND RESULTS OF OBJECTIVE C

Objective C. "To study the economy of marketing paint-free and paint wools of the same clip."

### Experiment No. C1

Six bags of graded scoured wools were selected for this test, two bags of Fine wool and 4 bags of 1/2 blood wool. One bag of Fine and 2 bags of 1/2 blood were depainted by clipping off the crusted branding-paint clumps with shears and by pulling the clumps off the staples with the fingers.

The average amount of paint brands separated from these scoured wools was 1.61 percent by weight. This separated paint-brand material is not entirely paint because it contains many short tufts of wool fibers embedded in the dry paint clumps. Paint brand on wool is a triple defect because (1) it causes the wool to be discounted, (2) it is a constituent of shrinkage, and (3) in extracting paint a certain amount of fiber loss is incurred. Also, it has been known that, in a few instances, sheep-branding fluids tended to permeate into surrounding fibers during scouring.

These six bags of wool were sold on the market as paint-free and paint-containing scoured wools.

Selling values of these four lots are given in Table 21.

The two scoured paint-free lots outsold the two lots with paint by 5c per pound for the Fine wool and 2c per pound for the 1/2 blood wool, and these differences represented 1.75c and 0.76c per pound, respectively, on the grease basis.

Only two price comparisons were obtained in this test. The lots were

**TABLE 21—Selling values of paint-free and paint-containing scoured wools**

| Lot | Weight *(pounds)* | Sale price scoured basis *(cents per pound)* | Grease value Fine 65% shrink ½ blood 62% shrink *(cents per pound)* |
|---|---|---|---|
| Fine—Paint-free | 105 | 155.0 | 54.25 |
| Fine—with paint | 131 | 150.0 | 52.50 |
| Differences | | 5.0 cents | 1.75 cents |
| ½ blood—Paint-free | 187 | 130.0 | 49.40 |
| ½ blood—with paint | 104 | 128.0 | 48.64 |
| Differences | | 2.0 cents | 0.76 cents |

very small. The two lots of each quality were identical in every respect except for branding paint.

However, it would seem logical to assume that market demand will show a price preference for wool without branding paint or wool that carries quaranteed scourable branding paint above wool branded with un-scourable paint.

## DISCUSSION AND RESULTS OF OBJECTIVE D

Objective D. "To study the feasibility of various methods of wool preparation, the most efficient utilization of off-sorts and minor grades, and the measurements of various defects and their effect upon purity of the processed products."

This part of the work was activated by the results obtained in the previous experiments reported in this bulletin, and also by the work done on the inherent and externally caused defects of grease wools that result in value decreases of the processed products.

**TABLE 22—Sorting data for 3 bags graded Fine Staple and for 3 bags of ½ blood Staple**

| Graded wool | Sorted wool | |
|---|---|---|
| | **Taken out of sort** | **Left in sort** |
| Bag 15, Fine and Bag 12, ½ blood (Control bags) | Coarse wool, breech wool, short wool | Only Good F.C. and Staple wool |
| Bag 14, Fine and Bag 11, ½ blood | Coarse wool Breech wool | Short staple wool |
| Bag 13, Fine and Bag 10, ½ blood | Nothing | Coarse wool Breech wool Short wool |

### Experiment No. D1

Degree or intensity of sorting (preparation) of domestic grease wools required to produce acceptable processed products.

Three bags of commercially graded Fine Staple wool and 3 bags of graded 1/2 blood Staple wool from two warehouse lines were purchased and prepared by sorting. The black, stained, tags and paint wools were sorted out from each lot, and then each pair of bags, one Fine Staple and one 1/2 blood Staple, was sorted further as follow in Table 22.

These six bags were then scoured carded, and combed. The derived processing data follow in Table 23.

The six batches of top then were sent to two topmakers who appraised them at current market price levels as shown in Table 24. Several generalizations can be made:

(a) By extracting the coarse wools, breech wools and short wools from the above grease wools before processing them, the quality was increased in Fine top from 62s to 64s (Col. 2) and in 1/2 blood top from 58s to 60s (Col. 2).

(b) In the Fine lots, taking out coarse breech and short wools (Lot 15) increased the top value from $1.68 (Lot 13) to $1.72—a 2.4 percent value increase (Col. 3). For the ½ blood lots (12 and 10), the increase in top values due to sorting out the Coarse, Breech, and Short wools was from $1.56 a pound to $1.68 a pound—a 7.7 percent increase (Col. 3).

(c) Taking out the Short wools lowered the numbers of neps significantly by 39.8 percent (from 105.5 to 63.5, Table 23) in the Fine top, and by 27.3 percent (from 69.5 to 50.5, Table 23) in the 1/2 blood top.

(d) The large proportions of Short fibers present in all tops (Col. 4, Table 23) were discriminated against by the appraisers for being too high. This, plus the fact that noil yields were irregular, leads one to conclude that either excessive fiber breakage took place during carding, or that Short fibers were abnormally high in the wools in their original grease form, which is quite possible because these two lots were crossbred types.

**TABLE 23—Processing data for graded wools sorted to three intensities**

| Bag number | Fiber diameter of top *(microns)* | Fiber length of top *(inches)* | Fibers under 2 inches long in top *(percent)* | Nep count of top *(number per ½ oz.)* |
|---|---|---|---|---|
| 15 (Control) | 21.8 (64s) | 2.88 | 18.8 | 63.5 |
| 14 | 22.3 (64s) | 2.82 | 22.6 | 105.5 |
| 13 | 23.3 (62s) | 2.75 | 21.9 | 85.5 |
| 12 (Control) | 25.3 (60s) | 2.80 | 23.1 | 50.5 |
| 11 | 24.9 (60s) | 2.91 | 22.5 | 69.5 |
| 10 | 25.9 (58s) | 2.89 | 22.7 | 49.0 |

**TABLE 24—Appraisers' estimations of quality and value of the top from six sorted lots**

| (1) Lot number | (2) Description and degree of sorting | Topmakers' appraised values of tops *(per pound)* | Topmakers' estimated quality *(quality nos.)* | Prevailing market-price levels for tops same day as appraisals made *(per pound)* |
|---|---|---|---|---|
| 15 (control) | Fine (64s) Coarse & breech (1.7%) & short (0.9%) out | $1.72 | 64s | $1.73 |
| 14 | Fine (64s) Coarse & breech (6.9%) out, Short left in | $1.72 | 64s | $1.73 |
| 13 | Fine (62s) Coarse, breech, & Short left in | $1.68 | 62s | $1.65 |
| 12 (control) | ½ blood (60s) Coarse & breech (3.1%) & Short (1.9%) out | $1.68 | 58/60s | $1.52 |
| 11 | ½ blood (60s) Coarse & breech (5.2%) out, Short left in | $1.56 | 58/60s | $1.52 |
| 10 | ½ blood (58s) Coarse, breech, & Short left in | $1.56 | 58/60s | $1.52 |

## Experiment No. D2

Combing of tag wool and blending tag wool with staple wools.

In this test, scoured Fine tag wool was carded and submitted to combing, and Fine tag wool was blended with ½ blood scoured wools to ascertain if these practices might be commercially feasible.

Approximately 1,000 lbs. of Fine tags (grader's sort) were purchased from a wool warehouse. These were dusted and scoured and the black and stained pieces were carefully picked out on the dryer apron. Sorted, scoured ½ blood Staple wool was used as the two lines into which tag wool was blended, and one lot was left intact as one control containing no tag wool. One lot of scoured tags was the other control.

The preparation and processing data for each lot are contained in Table 25.

After Lot No. 7 had been carded it could not be combed because of the inferior fiber length of 1.22 in. This lot had to be sold as card sliver, or "carded stock," according to wool-trade classification.

In the data of Table 25 the following points are evident:

(a) Fiber length of the pure ½ blood top was 2.91 in., that of the 75 percent 1/2 blood, 25 percent tag lot, was 2.73 in., and that of the 90 percent 1/2 blood, 10 percent tag lot, was 2.85 in. Comparing these figures with their respective lot noilages one finds that the greater the adulteration with tag wool, the greater the noilage.

(b) The fiber length of the tops seems to decrease with the greater admixture of tag wool, but probably these decreases would not be significant in manufacturing.

Two qualified members of the wool trade, a broker and a topmaker, appraised these products. The valuations they gave are in Table 26. Points of interest follow.

(a) Carded tags (Lot 7) were valued at $1.05 to $1.10 a pound when the clean basis value for 1/2 blood Good French Combing and Staple wool was quoted at $1.35 maximum in the weekly Boston wool market price report —a difference of only 18.5 per cent based on the grease-form value.

(b) The top derived from control Lot 11 was appraised at $1.56 a pound. Tops from Lot 8 (with 25% tags) and Lot 9 (with 10% tags) were both appraised at $1.62 a pound.

No explanation for this phenomenon can be found: the appraisers worked independently and did not know the fiber measurements of

**TABLE 25—Data for tag wool and blends with ½ blood wool**

| Lot number | Preparation | Process | Fiber length: Card sliver *(inches)* | Fiber length: Top *(inches)* | Quality number of product | Yield of noils from scoured wool *(percent)* |
|---|---|---|---|---|---|---|
| 7 tags (control) | Not blended | Carded | 1.22(60s) | ---- | 60s | ---- |
| 11 ½ blood staple (control) | Not blended | Carded & combed | 2.53 | 2.91 | 60s | 9.4 |
| 8 | 75% ½ blood 25% Fine tag wool | Carded & combed | 2.50 | 2.73 | 60s | 15.2 |
| 9 | 90% ½ blood 10% Fine tag wool | Carded & combed | 2.49 | 2.85 | 60s | 12.1 |

**TABLE 26—Appraised market values of carded tags and wool top.**

| Lot | Description | Appraised values *(cents per pound)* | Date | Market levels: Top *(per pound)* | Market levels: Grease wool *(per pound, clean basis)* |
|---|---|---|---|---|---|
| 7 | Carded tags (60s) (control lot) | $1.05-$1.10 | Nov. 2, 1956 | 58/60s $1.73 | $1.30-$1.35 |
| 11 | Top (60s) (control lot) | $1.56 | May 4, 1956 | 58/60s $1.52 | $1.18-$1.22 |
| 8 | Top (60s) 75% ½S+25% tags | $1.62 | May 4, 1956 | 58/60s $1.52 | $1.18-$1.22 |
| 9 | Top (60s) 90% ½S+10% tags | $1.62 | May 4, 1956 | 58/60s $1.52 | $1.18-$1.22 |

the products. On the other hand, this appears to substantiate the oft-stated adage that "there's a lot of good wool in tags."

## Experiment No. D3

Reliability of processing grease wool into top and noil (top-and-noil test for grease wool).

Two commercially graded lots of wool, one Fine Staple and Good French Combing and one 3/8 blood Staple and Good French Combing, were used. The Coarse wool, tags, and stained wool were sorted out of each; they were then scoured by standard procedure.

Each scoured lot was homogenized by passing it through the feeder of the dryer several times. Then each lot was divided into approximately 3 portions so that each scoured sublot weighed between 80 and 100 lbs. These sublots were then carded and combed.

The processing data are given in Table 27.

Lots 4, 5, and 6 were combed on the Noble comb and Lots 1, 2, and 3 on the French comb. These products in each phase were tested by type for significance of the differences obtained. There were no significant differences in yields of top and noil between sublots within type at the 0.05 percent level.

Based upon these results, the processing of one sample of scoured wool from a homogenized lot should yield reliable results. However, to account for some measure of the natural differences between samples, **duplicate** samples should be separately processed.

**TABLE 27—Results for processing triplicate sublots of sorted Fine and Medium wools**

| Sublot number | Type | Card yield *(per cent)* | Card waste *(per cent)* | Top yield *(per cent)* | Noil yield *(per cent)* |
|---|---|---|---|---|---|
| 1 | Fine | 93.28 | 6.72 | 69.58 | 20.61 |
| 2 | Fine | 92.74 | 7.26 | 69.12 | 19.54 |
| 3 | Fine | 93.28 | 6.72 | 70.77 | 20.17 |
| 4 | Medium | 93.78 | 6.22 | 78.41 | 12.44 |
| 5 | Medium | 95.94 | 4.06 | 81.63 | 11.80 |
| 6 | Medium | 94.59 | 5.41 | 77.51 | 10.50 |

## Experiment No. D4

Analysis of two wool clips for quality and staple length.

This, the final phase of these projects, was undertaken to obtain basic data on the variability of commercial grades, staple lengths, and inferior sorts contained in range clips, and to obtain processing-performance data for the various sorts found.

One Fine wool clip and one 1/2 blood clip, both being reputation Wyoming clips, were anlyzed as described below.

As the tied ewe fleeces were carried from the shearing floor to the sacking stand, the operator picked fleeces at random for the samples. He graded each sample fleece for quality number and staple-length class, weighed it, and placed it in the appropriate value class.

FINE CLIP, PUREBRED RAMBOUILLET

The distinctive types found in this clip enabled the investigator to grade the fleeces according to quality number and not to blood grade.

In the laboratory each class was sorted by a professional wool sorter. He abstracted from each fleece all Short wool, tags, and stained pieces so that, in the final sorted line, there were no wools that might degrade the quality and uniformity.

No coarse wools were found in any fleeces in this clip, which is exceptional for range wools.

HALF BLOOD CLIP, ½ BLOOD CROSSBRED, TARGHEE TYPE

This clip also was graded at the shearing pen, but the grades were made according to the Blood system because, being a crossbred clip, the grades were broader than would normally be found in a clip from purebred sheep. All fleeces in the sample bags then were sorted by the professional wool sorter. In this clip also he abstracted the Coarse wool, Short wool, tags, and stained

pieces. The Coarse wools taken from each sorted line were placed in the appropriate lower sorted lines acording to quality and staple length.

To accentuate the differences between these two clips they are contrasted for each character studied in the following tables.

There are several points of interest in Table 28.

(a) The amounts of Staple wools in each clip are 56.0 percent for the Fine clip and 51.0 for the 1/2 blood clip. These proportions are much below expectations, for both clips had a very high reputation.

Based upon these percentage proportions by weight, the Fine clip has realized only **56.0 percent** of its potential staple length, and the 1/2 blood clip has realized only **51.0 percent** of its staple-length potential.

(b) The amounts of French Combing wools (medium length) are 39.0 percent and 42.3 percent respectively.

(c) The Fine clip has no Clothing (short length) wool, the ½ blood clip has 2.0 percent.

(d) No coarse breech wool was found in the Fine clip, and 1.3 percent was found in the 1/2 blood clip.

(e) Staple lengths for the Fine clip grades were slightly shorter than those found for the 1/2 blood clip because one clip was distinctly finer than the other.

More detailed analyses of the sorts made in each grade of fleeces are found in Tables 29 and 30. There are several points of interest in contrasting the sorting data for the Fine and 1/2 blood clips.

**TABLE 28—Total sorts made from grades and their staple lengths**

| All grades | Fine clip 70s to 60s grade *(percent)* | ½ blood clip 64s to 50s grade *(percent)* | Fine clip Staple length *(inches)* | ½ blood clip Staple length *(inches)* |
|---|---|---|---|---|
| Staple wools | 56.0 | 51.0 | 3.0 | 3.3 |
| French Combing wools | 39.0 | 42.3 | 2.5 | 2.8 |
| Clothing wool | 0 | 2.0 | 1.9 | 2.0 |
| Breech wools | 0 | 1.3 | --- | --- |
| Tag wools | 5.0 | 3.4 | --- | --- |
| | 100.0 | 100.0 | | |

**TABLE 29—Fine clip: sorts made from shearing-pen grades**

| Sorted classes | Shearing-pen grades | | | | |
|---|---|---|---|---|---|
| | 70s staple *(percent)* | 70s Fr. Comb. *(percent)* | 64s Staple *(percent)* | 64s Fr. Comb. *(percent)* | 60s Staple *(percent)* |
| 70s Staple | 86.8 | ---- | ---- | ---- | ---- |
| 70s Fr. Combing | 8.6 | 95.8 | ---- | ---- | ---- |
| 64s Staple | ---- | ---- | 86.8 | ---- | ---- |
| 64s Fr. Combing | ---- | ---- | 7.7 | 94.6 | ---- |
| 60s Staple | ---- | ---- | ---- | ---- | 86.7 |
| 60s Fr. Combing | ---- | ---- | ---- | ---- | 7.8 |
| Tags & Stained | 4.6 | 4.2 | 5.5 | 5.4 | 5.5 |

**TABLE 30—One-half blood clip: sorts made from shearing-pen grades**

| Sorted classes | Shearing-pen grades | | | | |
|---|---|---|---|---|---|
| | Fine Staple *(percent)* | ½ Blood Staple *(percent)* | ½ Blood Fr. Comb. *(percent)* | ⅜ Staple *(percent)* | ⅜ Blood Fr. Comb. *(percent)* |
| 64s Staple | 83.0 | ---- | ---- | ---- | ---- |
| 64s Fr. Comb. | 9.7 | ---- | ---- | ---- | ---- |
| 60s Staple | 1.5 | 80.9 | ---- | ---- | ---- |
| 60s Fr. Comb. | ---- | 6.0 | 82.4 | ---- | ---- |
| 60s Clothing | ---- | ---- | 5.1 | ---- | ---- |
| 56s Staple | ---- | 10.3 | ---- | 74.6 | ---- |
| 56s Fr. Comb. | ---- | ---- | 9.9 | 9.5 | 86.1 |
| 56s Clothing | ---- | ---- | ---- | ---- | 4.8 |
| 50s Staple | ---- | ---- | ---- | 8.5 | ---- |
| 50s Fr. Comb. | ---- | ---- | ---- | ---- | 4.6 |
| Breech | 1.6 | ---- | ---- | 3.5 | 1.3 |
| Tags & Stained | 4.2 | 2.8 | 2.6 | 3.9 | 3.2 |

(a) Proportions of **Staple wools** are higher for the Fine clip, being 86.6, 86.8, and 86.7 percent respectively, than the 83.0, 80.9, and 74.6 percent found in the 1/2 blood clip.

(b) There were no lower quality sorts in the grades of the Fine clip, but the grades of the 1/2 blood clip each contained detrimental amounts of lower grade wool, as follow:

Fine Staple contained
1.5% 1/2 blood

1/2 blood Staple contained
10.3% 3/8 blood

1/2 blood French Combing contained
9.9% of 3/8 blood

3/8 blood Staple contained 8.5% of 1/4 blood

3/8 blood French Combing contained 4.6% of 1/4 blood

(c) Hairy breech wools were not present in the Fine clip, but the Fine Staple, 3/8 blood Staple, and 3/8 blood French Combing grades of the 1/2 blood clip had 1.6, 3.5, and 1.3 percent of hairy breech wool respectively.

(d) The tags and stained sort averaged 5.0 percent by weight per grade in the Fine clip and 3.3 percent by weight of the 1/2 blood clip grades.

## Experiment No. D5

Variability in characters of range clips.

Continuing this work of analyzing wool clips, six range clips were sampled by taking one bag of fleeces at random of each major grade present in the clip.

Initially it was planned to obtain processing data on carding and combing of all grades analyzed, but serious technical difficulties were encountered in the processing system used and this phase of the project had to be abandoned.

In the Wyoming University Laboratory, each fleece was sorted by the skilled commercial sorter; all tags, stained pieces, coarse breech wool, and other off-grade portions were removed. All major and minor sorts were weighed; staple samples were obtained by the hook method, by which staples are pulled at random from the packed bag by means of a thin 24-in. metal bar having a small hook at one end and an oval handle at the other.

As is done for wool clips in commercial practice, each sample bag was prepared in its entirety and not as a component of the clip. In other words, because each sample bag represented a major grade from the clip, all sorts made from the bag were kept separate.

None of these clips was commercially graded by the wool grower before sale.

Derived data from sorting and proportions of major grades found in these clips are listed in Appendix Table 1. In condensed form these data appear in Table 31.

Within each clip the amounts of graded wool (lines 1 and 4) total 100 percent except in the case of clip no. 1, which contained 5.7 percent of minor grades.

There are many contrasts and a few similarities in the data contained in Table 31. It should be remembered that grease-wool grades, sorts from grades, and clean-wool-fiber data comprise this array.

**Staple grades** in these 6 clips (line

**TABLE 31—Summary of clip analysis data for 6 range wool clips**

| | | Clip number | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Line | Grades and sorts | No. 1 | No. 2 | No. 3 | No. 4 | No. 5 | No. 6 | Average |
| (1) | Percentage weight of Staple **grades** in clip | 35.4* | 26.3 | 53.5 | None | 29.1 | 33.0 | 29.6 * |
| (2) | Percentage weight of Staple **sorts** in clip | 22.4 | 21.1 | 40.7 | None | 21.1 | 24.5 | 21.6 |
| (3) | Percentage of French Combing wools in Staple grades | 32.2 | 17.2 | 10.3 | No Staple | 24.8 | 20.9 | 17.5 |
| (4) | Total percentage of French Combing grades | 58.9* | 73.7 | 46.5 | 100.0 | 70.9 | 67.0 | 69.5* |
| | Percentage weight of: | | | | | | | |
| (5) | Very short wools | 6.5 | 2.7 | None | 2.1 | None | None | 1.8 |
| (6) | Tags | 6.1 | 2.3 | 5.7 | 3.8 | 2.7 | 3.1 | 4.0 |
| (7) | Shorts and Tags | 12.6 | 5.0 | 5.7 | 5.9 | 5.7 | 3.1 | 5.8 |
| (8) | Average weight of clean wool fiber per fleece (pounds) | 3.2 | 3.5 | 4.1 | 3.6 | 4.1 | 3.7 | 3.7 |

*Clip No. 1 also contained minor grades from 58s to 56s totalling 5.7% by weight.

1) vary from zero to 53.5 percent with an average of 29.6 percent by weight of clip.

However, the actual amounts of **Staple sorts** by clip (line 2) vary from zero to 40.7 percent by weight of clip, with an average of 21.6 percent.

The amounts of French Combing wool sorts made from these commercial staple grades (line 3) vary from zero to 32.2 percent with an average of 17.5 percent.

Total amounts of the medium-length wools (French Combing) range from 46.5 to 100.0 percent with an average of 69.5 percent (line 4).

Very short wools (line 5) vary by clip from zero to 6.5 percent, and tag contents (line 6) vary from 2.3 to 6.1 percent. There are 12.6 percent of the Shorts and tags combined (line 7) in clip no. 1 and only 2.7 percent in clip no. 5.

By clip the average clean-wool-fiber weight per fleece (line 8) varies from 3.2 to 4.1 lbs. with an average of 3.7 lbs.

This analysis reveals certain points concerning each clip that are of value in determining its relative excellence. In rating the performance of any clip the potentials of the various characters studied should be kept in mind. For instance, for highest efficiency these six clips under consideration should be composed of only Staple wools, which are superior in length and value to the French Combing and Clothing wools.

**Clip No. 1.** The factors that detract from the value of this clip are: the excessive amount of low-value

Short wools and tags (12.6%), the large quantity of French Combing wool in the Staple grade (32.2%), and the comparatively low clean-fleece weight of 3.2 lbs.

**Clip No. 2.** This clip is comparatively low in amount of Staple wool (21.1%), higher than average in French Combing lengths (73.7%), and fairly high in defects of very short wools and tags (5.0%).

**Clip No. 3.** Comparatively high in amount of Staple wools (40.7%), high in clean fleece weight (4.1 lbs.), but also high in the defective very short wools and tags (5.7%).

**Clip No. 4.** Would have a low rating because it does not have any staple-length wools and is above average in amounts of short wools and tags (5.9%).

**Clip No. 5.** Has no very short wools and comparatively few tags (2.7%), but it has a low quantity of Staple wools (21.1%) and a higher-than-average amount of French Combing sort in the Staple grades (24.8%). The clean-wool weight per fleece is comparatively high (4.1 lbs.).

**Clip No. 6.** Not very high in proportion of the valuable Staple wools (24.5%), although it contains 2.9 percent more than the average for the 6 clips (21.6%).

## APPENDIX TABLE 1

**Grades and sorts in six Wyoming range wool clips**

### Clip No. 1

Rambouillet breeding with small amount of Lincoln x Rambouillet blood—**Crossbred Fine type**

a. **Major divisions in clip:**

| Grades | Proportion by weight *(percent)* |
|---|---|
| 70s Fr. Comb. | 27.2 |
| 64s Staple | 35.4 |
| 64s Fr. Comb. | 16.3 |
| 62s Fr. Comb. | 6.4 |
| 60s Fr. Comb. | 9.0 |
| Minor grades (58s S & FC., 56s S & FC.) | 5.7 |

### Clip No. 2

Rambouillet breeding. No other breeds used to cross with these sheep—**Fine-wool type**

a. **Major grades in clip:**

| Grades | Proportion by weight *(percent)* |
|---|---|
| 70s Fr. Comb. | 27.3 |
| 64/70s Staple | 26.3 |
| 64s Fr. Comb. | 33.1 |
| 62/60s Fr. Comb. | 13.3 |

b. **Sorts from major grades:**

| **Grade** | Sorts found *(percent)* | Staple length *(inches)* |
|---|---|---|
| 70s French Comb. | 70sFC—44.2 | 2.5 |
| | 70sClo.—21.4 | 2.2 |
| | 64sFC—26.1 | 2.2 |
| | 60/62sFC—1.4 | 2.4 |
| | Tags—6.9 | 2.0 |
| 64s Staple | 64sS—63.2 | 2.7 |
| | 64sFC—18.7 | 2.4 |
| | 62sFC—11.1 | 2.7 |
| | 60sFC—2.4 | 3.0 |
| | Tags—4.6 | 2.6 |
| 64s French Comb. | 64sFC—60.0 | 1.9 |
| | 64sClo.—10.9 | 1.6 |
| | 62sFC—17.1 | 2.0 |
| | 60sFC—6.2 | 1.9 |
| | 58sFC—0.8 | 2.5 |
| | Tags—5.0 | 2.0 |
| 62s French Comb. | 62sFC—71.3 | 2.9 |
| | 60sFC—13.6 | 2.4 |
| | 58sFC—8.4 | 3.4 |
| | 56sFC—1.1 | 3.4 |
| | Tags—5.6 | 2.7 |
| 60s French Comb. | 60sFC—73.8 | 2.8 |
| | 58sFC—16.6 | 3.2 |
| | 56sFC—1.3 | 3.0 |
| | Tags—8.3 | 2.5 |

b. **Sorts from major grades:**

| **Grade** | Sorts found *(percent)* | Staple length *(inches)* |
|---|---|---|
| 70s French Comb. | 70sFC—77.7 | 2.2 |
| | 70sClo.—10.7 | 1.9 |
| | 64sFC—8.5 | 2.3 |
| | Tags—3.1 | 1.7 |
| 64/70s Staple | 64/70sS—80.1 | 2.6 |
| | 64/70sFC—12.8 | 2.2 |
| | 64sFC—4.4 | 2.2 |
| | Tags—2.7 | 2.2 |
| 64s French Comb. | 64sFC—93.2 | 2.3 |
| | 60/62sFC—4.3 | 2.4 |
| | Tags—2.5 | 1.7 |
| 62/60s French Comb. | 62/60sFC—94.0 | 2.7 |
| | 58sFC—3.8 | 2.6 |
| | Tags—2.2 | 2.5 |

c. **Summary—5 grades**

| | |
|---|---|
| Average amount of wool **on grade** | 62.5% |
| Average amount of **on grade** staple in (one) staple grade | 63.2% |
| Average amount of **on grade** French Combing in French Combing grades | 62.3% |
| Average amount of Clothing (very short) wool in grades | 6.5% |
| Average amount of tags in grades | 6.1% |

c. **Summary—4 grades**

| |
|---|
| 86.3% |
| 80.1% |
| 88.3% |
| 2.7% |
| 2.3% |

## Clip No. 3

Foundation of Rambouillet x Lincoln, Panama, and Columbia rams. Present method is to breed Rambouillet rams to coarser wooled ewes and Columbia rams to Fine-wooled ewes —**Crossbred Fine type.**

a. **Major grades in clip:**

| Grade | Proportion by weight *(percent)* |
|---|---|
| 64s Staple | 18.7 |
| 60/62s Staple | 34.8 |
| 58s French Comb. | 21.6 |
| 56s French Comb. | 24.9 |

b. **Sorts from Major grades:**

| **Grade** | Sorts found *(percent)* | Staple length *(inches)* |
|---|---|---|
| 64s | 64sS—64.4 | 2.7 |
| Staple | 64sFC—13.6 | 1.9 |
| | 60/62sFC—15.1 | 2.4 |
| | Tags—6.9 | 2.0 |
| 60/62s | 60/62sS—82.4 | 3.1 |
| Staple | 58sFC—9.9 | 3.3 |
| | 56sFC—2.6 | 2.9 |
| | Tags—5.1 | 2.8 |
| 58s | 58sFC—83.1 | 2.8 |
| French | 56sFC—12.1 | 2.7 |
| Comb. | Tags—4.8 | 2.2 |
| 56s | 56sFC—88.3 | 2.9 |
| French | 54sS—5.8 | 3.7 |
| Comb. | Tags—5.9 | 2.3 |

c. **Summary—4 grades**

| | |
|---|---|
| Average amount of wool **on grade** | 79.8% |
| Average amount of **on grade** Staple in Staple grades | 53.4% |
| Average amount of **on grade** French Coming in French Combing grades | 85.7% |
| Average amount of Clothing (Very) short) wool in grades | None |
| Average amount of tags in each grade | 5.7% |

## Clip No. 4

Foundation of Columbia ewes crossed with Rambouillet rams for 3 years —**Crossbred Fine type.**

a. **Major grades in clip:**

| Grade | Proportion by weight *(percent)* |
|---|---|
| 64s French Comb. | 17.8 |
| 60/62s French Comb. | 57.1 |
| 58s French Comb. | 25.1 |

b. **Sorts from major grades:**

| **Grade** | Sorts found *(percent)* | Staple length *(inches)* |
|---|---|---|
| 64s | 64sFC—88.4 | 2.3 |
| French | 64sClo.—6.2 | 1.9 |
| Comb. | 60/62sFC—2.5 | 2.1 |
| | Tags—2.9 | 1.9 |
| 60/62 | 60/62sFC—94.4 | 2.3 |
| French | 58sFC—1.3 | 2.3 |
| Comb. | Tags—4.3 | 2.2 |
| 58s | 58sFC—94.5 | 2.7 |
| French | 56sFC—1.3 | 2.8 |
| Comb. | Tags—4.2 | 2.7 |

c. **Summary—3 grades**

| | |
|---|---|
| | 92.4% |
| | None |
| | 92.4% |
| | 2.1% |
| | 3.8% |

## Clip No. 5

Rambouillet foundation crossed with Lincoln x Rambouillet rams and Columbia rams—**Crossbred Fine type**

a. **Major grades in clip:**

| Grade | Proportion by weight *(percent)* |
|---|---|
| 64/70s Staple | 29.1 |
| 64/70s French Comb. | 38.3 |
| 60/62s French Comb. | 25.9 |
| 58s French Comb. | 6.7 |

b. **Sorts from major grades:**

| Grade | Sorts found *(percent)* | Staple length *(inches)* |
|---|---|---|
| 64/70s Staple | 64/70sS—72.5 | 2.6 |
| | 64/70sFC—9.1 | 2.4 |
| | 60/62sFC—15.3 | 2.9 |
| | 58sFC—0.4 | 2.5 |
| | Tags—2.7 | 2.5 |
| 64/70s French Comb. | 64/70sFC—94.3 | 2.2 |
| | 60/62sFC—3.0 | 2.6 |
| | 58sFC—0.3 | 2.2 |
| | Tags—2.4 | 2.1 |
| 60/62s French Comb. | 60/62sFC—83.8 | 2.7 |
| | 58sFC—12.2 | 2.8 |
| | 48/50sFC—0.9 | 2.7 |
| | Tags—3.1 | 2.5 |
| 58s French Comb. | 58sFC—84.8 | 3.3 |
| | 48/50sFC—12.7 | 3.5 |
| | Tags—2.5 | 2.7 |

c. **Summary—4 grades**

| | |
|---|---|
| Average amount of wool **on grade** | 83.9% |
| Average amount of **on grade** Staple in Staple grade (one) | 72.5% |
| Average amount of **on grade** French Combing in French Combing grades | 87.6% |
| Average amount of Clothing (very short) wools in grades | None |
| Average amount of Tags in each grade | 2.7% |

## Clip No. 6

Rambouillet foundation crossed with Columbia rams and Rambouillet rams—**Crossbred Fine type.**

a. **Major grades in clip:**

| Grade | Proportion by weight *(percent)* |
|---|---|
| 70s Staple | 8.6 |
| 64s Staple | 24.4 |
| 60/62s French Comb. | 36.2 |
| 58s French Comb. | 17.8 |
| 56s French Comb. | 13.0 |

b. **Sorts from major grades:**

| Grade | Sorts found *(percent)* | Staple length *(inches)* |
|---|---|---|
| 70s Staple | 70sS—70.0 | 2.6 |
| | 70sFC—14.1 | 2.4 |
| | 64sS—11.2 | 2.6 |
| | 60/62sFC—1.2 | 2.6 |
| | Tags—3.5 | 3.0 |
| 64s Staple | 64sS—75.7 | 2.7 |
| | 64sFC—8.1 | 2.7 |
| | 60/62sFC—11.5 | 2.9 |
| | 58sFC—1.3 | 2.9 |
| | Tags—3.4 | 2.6 |
| 60/62s French Comb. | 60/62sFC—87.6 | 2.8 |
| | 58sFC—8.1 | 3.4 |
| | 56sFC—0.9 | 3.2 |
| | Tags—3.4 | 2.8 |
| 58s French Comb. | 58sFC—82.2 | 3.0 |
| | 48/50sFC—13.4 | 3.4 |
| | Tags—4.4 | 2.9 |
| 56s French Comb. | 56sFC—92.2 | 3.1 |
| | 48sFC—3.5 | 3.3 |
| | Tags—4.3 | 3.2 |

c. **Summary—5 grades**

| | |
|---|---|
| Average amount of wool **on grade** | 81.5% |
| Average amount of **on grade** Staple in Staple grade (one) | 72.9% |
| Average amount of **on grade** French Combing in French Combing grades | 87.3% |
| Average amount of Clothing (very short) wools in grades | None |
| Average amount of Tags in each grade | 3.1% |

## LITERATURE CITED

(1) Johnston, D. D., H. Dean Ray, W. J. Manning, and E. M. Pohle. Relationship of staple length in grease wool and resultant top. Tex. Res. Jour. Vol. 21, Oct. 1951, pp. 757-762.

(2) Anon. Sampling and testing staple length of wool in the grease. A.S.T.M. Des. 1234-54. 1955. Am. Soc. for Test. Matls. Part 7. Textiles, etc., pp. 547-549.

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*University of Wyoming*
*Agricultural Experiment Station*
*N. W. Hilston, Director*
*Laramie*