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# Costs and returns from *SORTING FLEECE WOOLS* for market in the *PRODUCER'S WAREHOUSE*

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# COSTS AND RETURNS FROM SORTING FLEECE WOOLS FOR MARKET IN THE PRODUCERS WAREHOUSE

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Most foreign wools marketed in the United States command a higher price per clean pound than domestic produced wools of a comparable grade. Several factors account for these differences. First, justifiably or not, the sale of foreign made wool products and products made from foreign wools tend to have some prestige advantages over wool products manufactured from domestic wools. Second but probably most important, foreign wool producers who generally are dependent on wool as one of their major sources of income have made important progress in improving the quality of their wools. This has taken the form of improvements in breeds of sheep, ranch management techniques, and in the methods of removing and handling individual fleeces and presenting the wool for market. The import duty on imported wool, levied on a weight basis, has been an important factor in encouraging this type of improvement program. Since the import duty tax is levied on a weight basis on foreign wool marketed in this country, foreign producers have found it desirable to remove all the lower quality parts of the fleece such as the stained, coarse, gray, and black fibers. The voluntary compliance by most foreign wool producers with this system of preparing wool for market (skirting) has resulted in a highly uniform and very competitive raw wool product. For foreign producers this has resulted in the highest possible return per pound above transportation and duty charges for wool sold in this country.

In recent years as labor rates have increased in the United States, textile manufacturers have shifted to more high speed automatic wool processing equipment. To achieve efficient machine use and high quality in the finished textile product, a high quality and uniform raw wool material is needed.

Considerable variation is found within as well as between fleeces and clips of fleece wools produced in this country. Part of this intra-fleece and intra-clip variation is due to the widespread use of the cross-breeding programs common in the fleece state area. However, even

within pure blood lines of a particular breed of sheep, each fleece of wool has some distinguishable grade variations. For example, a finer grade of wool is found on the shoulder area as compared with the wool around the lower leg area. Because of these and other discernible intra-fleece variations, textile mills generally sub-divide or sort wool in the fleece to obtain the desired degree of uniformity in staple length and fiber diameters. Under presently known technology, this is still a hand sorting operation which entails the use of much high cost skilled labor at the textile mill. The production of sheep which have considerable intra-fleece variation in wool grades may not in itself be a deterrent to achieving the high returns from the total clip. In some years the finer grades represented in the fleece may be higher in value while in other years the coarser grades may be higher.

Generally fleece wools as currently marketed are not as free from stained, seedy, and tag wool locks as imported apparel wools. This contamination tends to reduce the price received per pound of clean wool. However, the real disadvantage appears to be in the amount of variability which exists in the product marketed. In general when a great deal of variability such as this exists, the product tends to move into a use consistent with the lowest value of the qualities represented. In order to achieve the full advantage of the higher price for the higher valued parts, it is necessary to separate the various grades and combine them with similar grades from other fleeces. The value of a lot of wool may be raised if it is put up in uniform lots and in sufficient quantities to meet processor needs. Several economic advantages may be expected to accrue to the processor from being able to buy already sorted uniform lots of a single grade of wool rather than tied fleeces.

1. He does not have to provide the facilities and pay high cost skilled labor for performing the operation.

2. He saves the cost of handling the offsorts and the probable loss which he may incur from disposing of the offsorts he could not use in the small lots he would be likely to have.

Preliminary research aimed at testing the feasibility of sorting fleece wools on the farm during the shearing operation to improve the quality of fleece wools suggested that quality and uniformity of the sorted wools could be controlled to a greater degree by performing the sorting operation at the wool warehouse concentration point.[1]

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[1]Russell McDonald and Richard R. Newberg, **Farm Sorting of Fleece Wools for Market,** O.A.E.S. Bulletin #849, Wooster, Ohio, February 1960.

The major objetives of this research are—

1. To develop an acceptable method of putting-up fleece wool at the producer warehouse.
2. To compare costs of alternative methods of putting-up fleece wool for market—with the operations performed on the farm and with the operations performed in the warehouse.
3. To determine market valuation and textile mill buyer acceptance of warehouse prepared wool presented for market.
4. To develop recommendations for future fleece wool preparation practices.
5. To recommend additional research needs in this area.

**Methods and Procedures**

To accomplish the objectives of this study, the following procedures were followed:

1. Individual fleeces of a graded lot of ¼ Blood wool were untied, sorted, bagged, (not retied) and marketed.
2. Time and cost data were collected on all operations involved in the preparation of the wool for market.
3. Data on unstretched fiber length were collected on the original lot of ¼ Blood graded wool and on the lots of sorted ¼ Blood wool to provide a measure of the improvement in uniformity.
4. Market valuation of wool was obtained by marketing the wool through regular channels.
5. The data were analyzed and conclusions drawn concerning the potential for improving wool by change in warehouse operation.
6. Recommendations are made for wool marketing agencies in the fleece wool states.
7. Types of additional research needed to improve wool put-up for marketing are pointed out.

**Design of Sorting Procedure**

Through consultations with management at the National Wool Marketing Corporation, Boston, Massachusetts, and at the Ohio Wool Growers Association coupled with the experience gained from the research results of the farm sorting phase,[2] procedures were developed for warehouse sorting of putting-up fleece wool. The combined information indicated that fleece wools probably could be sorted to yield greater uniformity in the final lot if the sorting operations were performed at a wool concentration point as compared with the first alternative tested under which sorting was performed by shearers on the farm at shearing time.

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[2]Op. cit., McDonald and Newberg.

Cooperation was obtained from the Ohio Wool Growers Association to supply the necessary quantity of wool and the labor to perform the sorting operation. Some further improvement in the sorting procedure was developed beyond that used in the earlier farm sorting experiment to more exactly meet processor requirements and to compete more favorably with imported skirted wools. In the final design of the sorting procedure, the following portions of each fleece were removed: (1) All twine used to tie individual fleeces; (2) feed grains (kernels of corn, oats, etc.) which commonly are found clinging to the wool fibers; (3) all manure tags and stained wool locks; (4) the portion of each fleece of a lower grade or higher grade. The wool was further subdivided by length into staple and clothing grades. The purpose of this step was to provide a lot of wool for which most of the fibers would be very close to the grade specification (48's—50's spinning count) for the ¼ Blood grade of wool used in this project.

**Equipment Used**

To aid in the removal of kernels of grain, hay chaff, and other loose foreign material contained in many fleeces, a 4 × 8 foot sorting table was constructed with a three foot square opening cut in the center. This opening was covered with a coarse hardware cloth (¾ inch square) to allow these foreign materials to fall out of the fleece as it was shaken out prior to and during the sorting operation (Figure 1).

To facilitate rapid movement of the various sorts obtained from each fleece during the sorting process, several containers and wool carts were grouped around the grading table. As the various parts were removed from each fleece, the grader placed them into the appropriate wool cart or container. The main sort was bagged (in untied form) as the wool cart containing the main sort was filled. The remainder of the sorts were not bagged until the sorting process terminated, or when sufficient volume was accumulated to make it worthwhile.

**Labor**

Three workers made up the labor force for the sorting operation—a professional grader and two helpers. One helper untied each fleece and placed it on the sorting table. The other removed and emptied the wool carts and containers as they were filled from the sorting table area and bagged the main sort in untied form.

At noon and in the evening the two helpers filled enough carts with the wool to keep the crew busy during the next half-day then they moved the wool from the unheated storage area to the sorting area where some heat was available. Since the sorting operation was per-

Fig. 1.—Tag locks and stained pieces of wool being removed from a fleece (untied) by wool grader Stanley Smith, Ohio Wool Growers Association, Columbus, Ohio.

formed during cold weather this allowed the cold wool to pre-heat slightly and soften the natural fleece oils. However, the coldness of the wool still was a handicap in untying and sorting.

## ANALYSIS OF TIME DATA

### Untying Fleeces

Time and motion data were obtained on picking up the fleece, cutting the paper twine on each fleece, removing the strings, and placing the untied fleece on the grading table. The helper who untied each fleece prior to the sorting operation used a small knife to cut all paper twine visible to him on one side of the fleece bundle. After cutting the twine, he pulled the short lengths of twine from the fleee. Any wool fibers clinging to the twine were "stripped" from the twine as it was pulled from the fleece. The helper took on the average, 53.78 seconds per fleece to perform these operations (Table 1). Based on current wage rates paid at the Ohio Wool Growers Association, this cost approximately 2.02 cents per fleece.

Most of the sorting operation was performed during the last few days of December and the first half of January, 1958-1959 when the outside temperature was cold. In general, the limited wool preheating period was not adequate to soften the natural fleece oils and to allow easy physical handling although it did help somewhat. On the "D"

**TABLE 1.—Summary of Means of Time Used to Untie Fleeces Prior to Sorting, Ohio, 1959**

(Each observation consists of an average of five fleeces)

(In seconds)

| Sample | Observations | | | | | Total | Mean |
|---|---|---|---|---|---|---|---|
| A | 54.8 | 41.6 | 52.4 | 55.0 | 41.6 | 245.4 | 49.04 |
| B | 53.4 | 55.2 | 51.6 | 45.0 | 48.4 | 253.6 | 50.72 |
| C | 58.2 | 64.6 | 48.4 | 43.8 | 47.8 | 262.8 | 52.56 |
| D* | 54.8 | 62.2 | 58.2 | 67.2 | 58.2 | 300.6 | 60.12 |
| E | 54.4 | 56.4 | 55.0 | 59.4 | 56.9 | 282.1 | 56.42 |
| Total | ---- | ---- | ---- | ---- | ---- | 1344.5 | 53.78† |

*Fleeces not preheated.

†Weighted average.

group of data in Table 1 the untying operation was performed on cold (completely unpreheated) fleeces (Table 1).

It was noted that the wool was "tacky" and the twine strings were more difficult to remove when the wool was cold. It was expected that the time used to untie cold fleeces as compared with preheated fleeces would be greater. The Null hypothesis that there is no effect of preheating on string removal time was tested (between observations D and A, B, C, E). The difference in time between preheated and unpreheated fleeces is statistically significant at the .05 probability level. Thus, it can be concluded that it requires less time for the string removal operation when the fleeces are preheated than when they are not preheated. Based on the average difference in time it costs about one-third of a cent more per fleece to untie cold fleeces compared with fleeces which have been preheated four or more hours.

**Sorting**

The professional wool grader who performed the sorting operation had experience grading and sorting wool for a woolen textile mill in Boston as well as grading and sorting wool for a Boston wool marketing agency.

The time and motion data collected included all motions the grader made. These included: (1) picking up the untied fleece, (2) shaking out the fleece, (3) removing the various sorts, and (4) tossing these sorts into their respective containers. Observations were taken in groups of ten fleeces.

It took an average of 65.91 seconds per fleece to perform the sorting operation (Table 2). At current wage rates this costs approximately 4.7 cents per fleece.

As noted in the preceding section observations during one-half day included sorting cold (not preheated) fleeces (Sample B afternoon, Table 2). It was expected that it would take less time on the average for the partially preheated fleeces (A, C, D, E) than cold fleeces. When the Null hypothesis of no difference was tested using Student's t-test, the difference was found to be statistically significant at the .05 probability level.[3]

The data show that it requires more time to sort cold fleeces than to sort fleeces which have been slightly preheated.[4]

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[3]Calculated t-value was 2.26.

[4]Preheating for a few hours showed a statistically significant reduction in untying time as well as in sorting time. This probably reflects that the limited depth of heating the wool in the fleece was beneficial.

**TABLE 2.—Summary of Means of Time Used per Fleece to Sort Untied Fleece Wool, by Morning and Afternoon, Columbus, Ohio, 1959**

(Each observation consists of the average time per fleece for a group of ten fleeces)

| Sample | Morning | Afternoon |
|---|---|---|
| | (Seconds) | (Seconds) |
| A | 48.0 | 53.8 |
| | 46.5 | 57.9 |
| | 56.2 | 56.7 |
| | 60.8 | 62.9 |
| | 49.8 | 51.4 |
| B | 82.9 | 73.8* |
| | 43.7 | 82.8 |
| | 65.7 | 57.4 |
| | 54.2 | 78.4 |
| | 61.4 | 77.6 |
| C | 75.7 | 71.6 |
| | 72.1 | 67.8 |
| | 66.8 | 67.4 |
| | 67.3 | 59.4 |
| | 69.5 | 70.8 |
| D | 75.8 | 66.1 |
| | 69.2 | 89.3 |
| | 73.3 | 61.0 |
| | 80.0 | 52.8 |
| | 78.2 | 56.4 |
| E | 72.0 | 70.7 |
| | 70.4 | 66.3 |
| | 66.9 | 54.5 |
| | 68.5 | 59.6 |
| | 78.4 | 66.7 |
| Total | 1662.9 | 1633.1 |
| Mean | 66.51 | 65.32 |

*Fleeces were not preheated, B group, afternoon.

## CLASSES OF WOOL OBTAINED FROM SORTING AND FIBER LENGTH ANALYSIS CLASSES OF WOOL

The test lot was made up of 35,004 pounds of graded ¼ Blood staple wool. From this initial quantity 24,920 pounds or 71.3 percent

**TABLE 3.—Amount and Percentage Distribution of Wool Sorts Obtained from Sorting Graded ¼ Blood Staple Wool, Columbus, Ohio, 1959**

| Grades Obtained | Weight (In pounds) | Percent of Total |
|---|---|---|
| **Staple Wood** | | |
| ½ Blood Staple | 80 | 0.2 |
| ¼ Blood Staple | 24,920 | 71.3 |
| ⅜ Blood Staple | 3,738 | 10.7 |
| Low ¼ Blood Staple | 1,127 | 3.2 |
| **Combing Wool** | | |
| ¼ Blood B. C. | 609 | 1.7 |
| **Off-Sorts** | | |
| Burry and Seedy | 1,906 | 5.4 |
| Crutchings | 1,915 | 5.5 |
| Medium Gray | 270 | 0.8 |
| Common and Deads | 46 | 0.1 |
| **Foreign Material** | | |
| String (paper twine) | 332 | 0.9 |
| Straw, Chaff and Other Foreign Material | 61 | 0.2 |
| Total | 35,004 | 100.0 |

went into the ¼ Blood staple grade (Table 3). Three-eights Blood staple made up the next largest amount (3,738 pounds or 11 percent). The remainder was divided as follows: 0.2 percent ½ Blood staple, 3.2 percent low ¼ Blood staple, 1.7 percent ¼ Blood combing, 5.4 percent Burry and Seedy, 0.8 percent Medium Gray, 0.1 percent Common and Deads, 5.5 percent crutchings and 1.1 percent paper twine, straw, chaff and kernels of small grains (Table 3).

## Fiber Length Analysis

Data were collected on unstretched fiber lengths of the original and sorted ¼ Blood staple wool. The mean length of the sample locks was expected to average approximately four inches. The coefficient of variation and standard deviation were expected to show the major lot of wool more homogeneous in relation to the original lot of unsorted wool. The distribution of lengths of staples are shown in Figure 2.

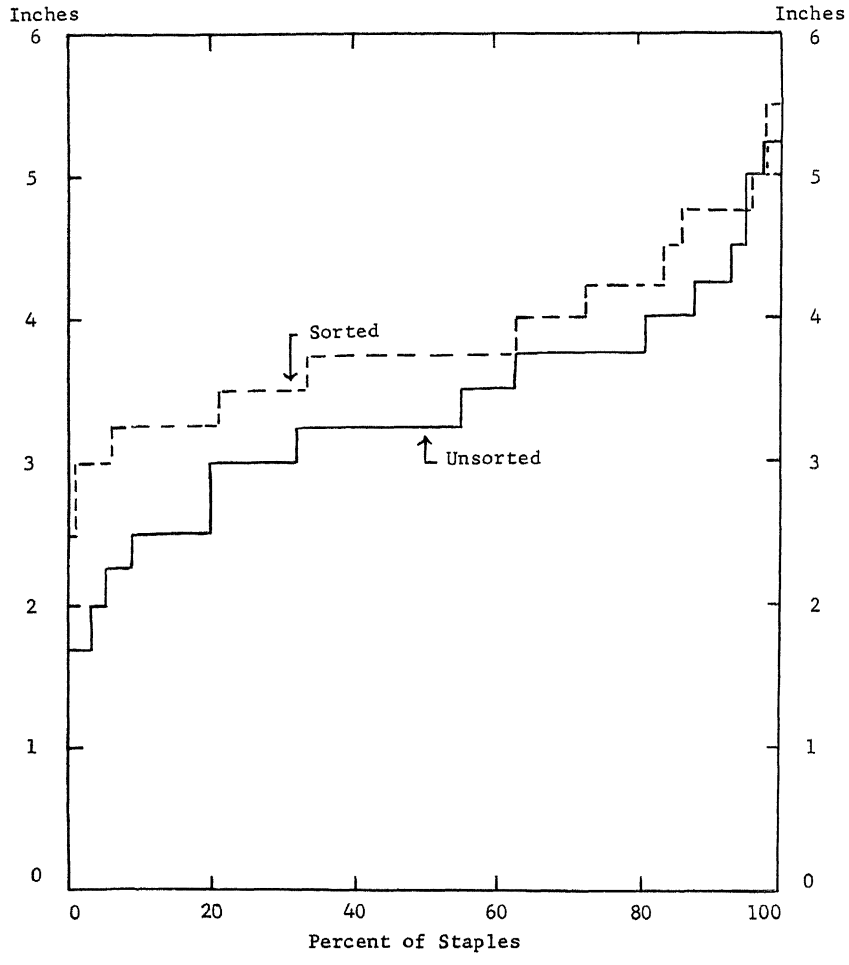


**Fig. 2.—Distribution of lengths of staples of sorted and unsorted wool, Ohio, 1958.**

A sample of 100 staples drawn at random from the lot of unsorted ¼ Blood staple wool had a mean staple length of 3.70 inches.[5] The standard deviation was 0.73 inches and the coefficient of variation was 19.7 percent (Table 4).

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[5]A staple is defined as one lock of wool drawn from a packed wool bag. Ten staples normally are drawn from each bag using a wool sampling tool. Each packed bag weighs about 250 pounds.

**TABLE 4.—Original Lot, Unsorted, Unstretched Staple Lengths, and Variation in Lengths of ¼ Blood Staple Graded Wool and Main Lots after Sorting, Columbus, Ohio, 1959**

| Sample Number | Mean Length (inches) | Standard Deviation (inches) | Coefficient of Variation* (percent) |
|---|---|---|---|
| **Unsorted Wool** | 3.70 | 0.73 | 19.70 |
| **Sorted Wool** | | | |
| A | 3.89 | 0.64 | 16.45 |
| B | 3.82 | 0.55 | 14.40 |
| C | 4.28 | 0.59 | 13.72 |
| D | 3.92 | 0.36 | 9.24 |
| E | 4.14 | 0.59 | 14.39 |
| F | 4.32 | 0.56 | 12.89 |
| G | 4.03 | 0.41 | 10.28 |
| H | 4.21 | 0.45 | 10.65 |
| I | 4.11 | 0.50 | 12.11 |

*This is the standard deviation divided by the average converted to a percent.

The average mean length of the sorted wool was 4.08 inches. Nearly 0.3 of one inch unstretched length was gained by removing a large percentage of the shorter wool fibers in the sorting operation, (Figure 2). The standard deviation was reduced from 0.73 inches to 0.52 inches. The standard deviation was reduced from 19.7 percent to 12.68 percent of the mean. After sorting, the main lot was more uniform as well as longer and the value of the resultant wool product was increased.

The reduction in the standard deviation of sorted wool from the standard deviation of the original sample indicates that the homogenity of the sorted lot of wool was increased. A comparison of the coefficient of variation between original and sorted lots of sample staple—19.7 and 12.7 percent, respectively, substantiates the gain in homogenity.

## WOOL PREPARATION COST AND RETURNS

### Costs

The costs of the wool sorting procedure were charged against the returns from the sale of the sorted wool for comparison of the returns from the sorted wool and the returns from the wool put-up under the regular method. These costs include all of the additional labor required

to perform the sorting operation beyond normal wool handling labor costs.

A total of 462 hours was used to perform the necessary sorting operation. Each helper accounted for 154 hours of the total. The grader also spent 154 hours. The three major jobs to be done were untying the fleece, sorting each fleece, and bagging the main sort of wool. The helper who bagged the main sort also kept the wool carts and containers emptied. Separate time and motion data were not recorded for the bagging operation.

Based on current wage rates at Ohio Wool Growers Cooperative, sorter costs were $394.24, and helper costs were $415.80. Total costs were $810.04. This total cost amounted to 2.314 cents per pound of wool sorted.

The grader used 154 hours to complete the sorting operation of 35,004 pounds of wool. He averaged 337.3 pounds per hour, or 1818.4 pounds of wool sorted per eight hour day.

**Returns**

The two major lots of sorted wool were shipped to Boston, Massachusetts. One of these lots included all of the 24,920 pounds of ¼ Blood staple wool and the other the 3,738 pounds of sorted ⅜ Blood staple wool. Together these two lots comprised approximately 82 percent of the total (Table 5).

Data were collected on the percentage shrink of these two lots. The ¼ Blood lot shrank 40.1 percent and the ⅜ Blood lot shrank 41.2 percent. Because of the cost, shrinkage on the lot prior to sorting was not obtained but for purposes of comparison, core test shrinks of all ¼ and ⅜ Blood graded wool marketed by the Ohio Wool Growers Cooperative in 1958 were averaged. These averages were 44.27 and 46.45 percent, respectively. The ¼ Blood sorted wool had a shrink of 4.17 percentage points less than the average for all ¼ Blood graded fleece wool and the shrink on the ⅜ Blood was 5.25 percentage points less than regular ⅜ Blood graded fleeces. The smaller shrink for the two lots of sorted wool was attributed to the removal of the high shrinking portions of the fleece during the sorting operation. This included not only crutchings, seedy and burry pieces, but also paper twine and chaff. Weight of paper twine and chaff together were over one percent of the weight of the original unsorted fleece wool (Table 5).

Data were also collected on the actual price received for these two lots of wool and a comparative price which would have been received if the wool had not been sorted but had been sold as graded fleece wool.

**TABLE 5.—Values of Various Sorts Obtained from the Original ¼ Blood Staple Graded Wool, Boston, Massachusetts, 1959**

| Grade | Pounds | Shrink (Percent) | Boston Price (Grease Price) | Total Revenue (Dollars) |
|---|---|---|---|---|
| **Sorted Wool** | | | | |
| ½ Blood Staple | 80 | ---- | 49 | 39.20 |
| ⅜ Blood Staple | 3,738 | 41 2 | 53 5 | 2,000.13 |
| ¼ Blood Staple | 24,920 | 40.1 | 52 72 | 13,135.85 |
| Low ¼ Blood Staple | 1,127 | ---- | 46 | 518.85 |
| ¼ Blood Clothing | 609 | ---- | 42 | 255.78 |
| Burry and Seedy | 1,906 | ---- | 41 | 781.46 |
| Crutchings | 1,915 | ---- | 25 | 478.75 |
| Medium Gray | 270 | ---- | 38 | 102.60 |
| Common and Pulled | 46 | ---- | 35 | 16.10 |
| String (paper twine) | 332 | ---- | ---- | -------- |
| Straw, Chaff, and etc. | 61 | ---- | ---- | -------- |
| Total | 35,004 | ---- | ---- | 17,328 29 |

Also, estimates of the Boston price (value) of the remaining lots were obtained. These smaller lots were not actually marketed at this time as the experimental quantities were too small. However, estimated prices were placed on the remaining lots based on the market valuation of these wools on the same market day that the two sorted lots were sold. This was during the second week of February, 1959.

The actual grease price received for the ¼ and ⅜ Blood sorted wool was 52.72 and 53.5 cents, grease basis, respectively. This yielded $13,135.85 and $2,000.13, respectively. Adding to this the estimated returns for the remainder of the grades of wool resulting from the sorting operation, the total value of the lot of sorted wool was $17,328.29 (Table 5).

The market value of the 35,004 pounds of ¼ Blood grade of unsorted wool was 46 cents per pound or a total of $16,101.84. Subtracting the labor costs of $810.04, a net gain of $416.40 or approximately 1.5 cents per pound was realized over a comparable amount of unsorted wool, normally graded fleece wool.

## Evaluation of Sorted Lot of Wool

An appraisal of the attributes of the warehouse sorted wool were obtained from the processor buyer of the wool, the marketing representatives of the Ohio Wool Growers Cooperative, and the National Wool Marketing Corporation. From the sale of these two major lots of warehouse sorted wools, an indication of the market acceptance can be obtained.

The purchaser reported that after a check of the wool by the textile mill's wool graders and sorters, the wool was found to be put-up in such a manner they were able to trap-sort the entire lot without further hand sorting.[6] In trap-sorting wool the textile mill merely dumps the wool into the blending operation or scouring vats as it comes from the wool bag without further sorting. This practically eliminates the high cost of hand labor at the plant to prepare the wool for processing. It also eliminates expenses and losses in disposing of small quantities of off-sorts where the plant, as is often the case, does not make blends which can utilize these other types or classes.

Observations of textile mill operations indicated that generally only foreign wools which had been skirted were trap-sorted. Since the textile mill did find it possible to trap-sort the project wool, this indicated the quality and uniformity of the wool was quite adequate to meet the mill requirements.

The Boston textile mill buyer who purchased this wool stated, "We would be very interested in purchasing future lots of wool prepared in this manner in larger volume lots."

Both marketing representatives of the Ohio Wool Growers Cooperative and the National Wool Marketing Corporation indicated in their opinion a little too much in off-sorts were taken from each fleece. The resultant lot was better prepared than actually was needed. It was suggested that if, in the future, additional lots of sorted wool are to be prepared in this manner, it would be advantageous to remove only about ten percent, or perhaps slightly less from the fleeces. Nearly 18 percent was removed during the sorting process on this experimental lot.

## Comparison with Warehouse and Farm Sorting of Fleece Wool

In the year prior to the initiation of the research dealing with the preparation of fleece wools for market in the producers warehouse, an

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[6]Wool to be trap-sorted must be uniform within the grade as well as free from off-colored stained locks, coarse hair-like wool fibers, seediness, chaff and other foreign materials.

alternative procedure was tested which included training sheep shearers to perform the sorting while shearing the sheep on the producer's farm.[7]

Several factors appeared to prevent full realization of the potential from this method. The experimental lot of farm prepared wool was not of sufficient size to adequately test the market. Buyers were not familiar with the product as presented for sale and the total weight of off-sorts compared with the main lot of wool was too high. Despite a good deal of effort to coordinate the work, differences in the amounts of wool removed from fleece by the various sheep-shearers resulted in larger weight of off-sorts and less uniformity in off-sorts. The relatively small size of farm flocks, and the fact that on each farm there might be individual animals producing wool ranging from low quarter to fine and from staple to very short fibers further complicated the efforts to achieve volume and uniformity in the lots. The major advantages of farm sorting compared with warehouse sorting are—(1) that with black faced sheep the white fibers can be completely removed first, which materially reduces the possibility of black fiber contamination. However, doing this increased the time and cost of shearing. (2) The cost of on-the-farm sorting was slightly less than the cost of warehouse sorting. (3) If this could be done adequately on a large scale basis, there would be less of a problem in finding skilled sorters.

Although the results of the study suggested that such an improvement in the farm method of putting-up wool in Ohio is economically feasible, a substantial amount of supervision of shearers was required to obtain the necessary uniformity.[8] Even with a major supervisory effort, if this method were attempted on a commercial scale over an entire state or several states, serious difficulty could be expected in obtaining uniformity in the operation.

Between the two methods, on farm sorting and warehouse sorting, the warehouse method appears to offer the most promise for several reasons.

1. Closer control of the sorting was possible and it provided greater uniformity in the matchings.

2. There were fewer off-sorts and the off-sorts could easily be shifted slightly to provide a certain matching to meet special blend requirements of processors.

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[7]Op. cit., McDonald and Newberg.

[8]In this experiment the supervision of the method was provided by the Ohio Agricultural Experiment Station staff. Time and travel in setting up and supervising the experiment were not charged up as a cost of the new method.

3. Supervisory costs were almost zero as compared with high supervisory costs for the farm sorting method.

4. As a method it seemed to have more appeal and higher prestige in the eyes of the processors.

**Conclusion**

In general, buyer comments and non-price evaluations of the experimental lots indicated that sorting or skirting and putting up wool as was done in the warehouse had several distinct advantages for processors. These are—

1. Eliminated processor costs of untying fleeces.

2. Greatly reduced processor labor costs as no additional sorting was needed.

3. Eliminated much of the foreign materials; tags, straw and hay chaff, seedy and burry portions of the fleece, and stains.

4. Significantly improved the uniformity of the lot. Grades in staple fibers were longer and more uniform in length.

5. Reduced gray and black fiber contamination as leg and face wools were removed.

The results of the warehouse sorting alternative for preparation of fleece wools for market indicates that it is economically feasible. Time data indicated it cost approximately 6.72 cents per fleece more than incurred using normal preparation methods. However, it is likely that a substantial reduction in costs can be achieved with better equipment, layout, and more experience with the technique.

Buyer evaluation of the lot of wool showed that the acceptability of the improved package was good. The textile mill buyer indicated that they were able to trap-sort the entire lot. This speaks well for the overall uniformity and quality. A higher percentage of off-sorts was removed than was really necessary (nearly 18 percent). Marketing personnel on both the state and national level emphasized that removing about ten percent would provide a fully adequate matching.

Although the actual returns of the warehouse sorted wool over usually prepared wool was less than expected, this market test strengthens the thesis that fleece wools can be sorted or skirted in a manner acceptable to the processor. Greater fiber uniformity plus complete absence of paper twine strings and removal of the high shrinking portions of the fleece may point the way toward better wool trade acceptance of fleece wools. Larger quantities of wool prepared in this manner must be offered regularly to increase familiarity with the attributes of

the product, and to make it possible for processors to key their operation to this type of raw material.

In addition to the above, the monetary returns received indicated a real advantage in shifting the sorting method of putting-up wool to the marketing agency from the processor.

**Recommendations**

Before a program affecting larger numbers of farmers and their prospective returns from the sale of a differentiated product can receive a blanket recommendation of approval, the reliability of the experimental results of the warehouse sorting wool preparation methods needs to be further tested and further refinements in the techniques need to be analyzed.

Larger numbers of lots sorted in the warehouse need to be put-up to provide a continuous supply of high quality uniform wool product and to provide a more adequate market test. In addition, research is needed to further refine—(1) physical handling of wool in the warehouse, (2) methods used in sorting and putting-up these wools, (3) methods of marketing the prepared lots, (4) measurements and standards for determination of quality of the product and for description of lots for buyers, (5) costs and returns realized from sale of sorted wools compared with wool as currently marketed.

## SUMMARY

The large differences found between clean wool prices of domestic and foreign wools of comparable grades and differences between textile manufacturers method of handling and acceptability of domestic wools as compared with foreign wools indicated need for improvement in preparation of domestic wools for market.

A study was made of the feasibility of changing the current wool preparation procedures to improve the market acceptance of fleece wools. Under a warehouse sorting procedure which was developed, portions of the fleeces which differed in fiber diameter, length or color were separated from the body wool which made up the main sort. This remaining part was combined with similar types of wool taken from other fleeces. The parts removed (offsorts) were put into appropriate grades based on the fiber characteristics.

A random sample of 35,000 pounds of graded quarter blood Ohio fleece wool was selected for the study of warehouse sorting. The results of this research project indicated that the sorting function could be performed economically at the warehouse. Costs reported are above those

normally incurred under current fleece wool preparation methods. Following is a summary of the time and cost data.

1. Starting with a lot of graded Ohio one-fourth Blood fleece wools, it cost about 2.02 cents per fleece to remove the (paper) twine from each fleece. This operation consumed about 53.8 seconds per fleece.

2. The wool grader used about 66.3 seconds per fleece to perform the sorting operation. This sorting job cost about 4.7 cents per fleece handled.

3. Total labor costs were $810.04 for the 35,004 pounds of wool handled. This was about 2.3 cents per pound to sort and prepare the wool for market.

4. The mean staple length of the main sort of the wools was 4.08 inches compared with an average of 3.7 inches for the graded fleece wools prior to sorting.

5. The yields of clean wool in the two major grades of ¼ Blood and ⅜ Blood graded fleece wools were increased from 56.7 and 54.6 percent for the unsorted fleeces to 59.9 and 58.8 percent, respectively.

6. The net returns from the sale of the warehouse sorted wool yielded a net gain (after deducting labor costs) of about 1.5 cents per pound over normally graded fleece wools.

7. Buyer evaluation of the lot of wool prepared in the warehouse indicated that the lot was put-up in such a manner that they were able to trap-sort the lot without any additional hand sorting. It is demonstrated by the price differential and the method of processor handling that improvement in ability of fleece wool to meet processor requirements can be achieved by sorting of the fleeces prior to marketing.