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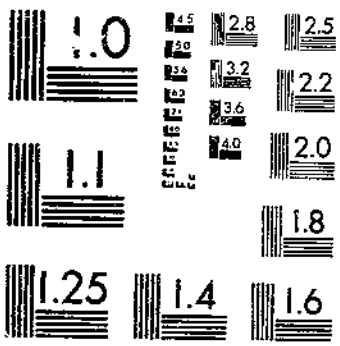

MICROCOPY RESOLUTION TEST CHART
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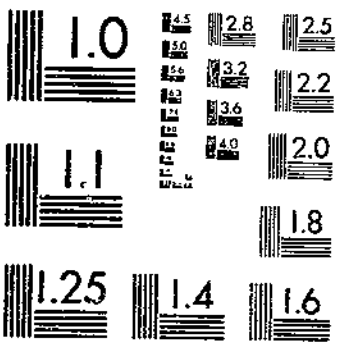

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NATIONAL BUREAU OF STANDARDS-1963-A

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Economics of Preparing Wool for Market and Manufacture[1]

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CONTENTS

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SUMMARY AND CONCLUSIONS

Market outlets for wool produced in this country are restricted by increased competition from well-prepared imported wools and from manmade fibers. Further expansions in production of these competing fibers are expected. Increases in costs of labor and in use of high-speed manufacturing machinery which requires more uniform fibers further weaken the competitive position of our wool. The central purpose of this study is to explore possibilities of strengthening the competitive position of domestic wool through improvements in preparation and marketing.

Production of wool in this country has declined markedly in recent years and is now at a low level in relation to domestic consumption and to production in other countries. In 1942, production of domestic wool totaled 455 million pounds, grease weight, and was almost 11 percent of the world total. In the early fifties, production had decreased to less than 260 million pounds, or about 6 percent of the world total. Factors responsible for this decrease include scarcity of help on farms and ranches and the increased costs of labor, losses from predatory animals, reductions in grazing allotments on public lands, and the relatively low returns from sheep.

Small flocks account for a substantial part of the shorn wool produced in this country. In 1949, for example, about 32 percent of the number of sheep and lambs shorn in the 11 Western States and Texas were in flocks of fewer than 1,000, and 57 percent were in flocks of fewer than 2,500. The small quantities of wool produced on many farms and ranches complicate the problem of skirting, grading, and otherwise adequately preparing the wool at or near the ranch for marketing and manufacture.

Wool varies in fineness, length, and other elements of quality from one fleece to another and from one part of the fleece to another. Preparation of wool for most effective use by manufacturers means that the fleeces and the wool in individual fleeces must be separated on the basis of differences in quality. The separated parts must then be combined into lots of uniform quality. This assorting and grouping may take place at any one or more stages in the marketing procedure, but usually the wool produced in the United States is not adequately skirted and well graded until after it leaves the farm or ranch.

Relative advantages and disadvantages of preparing wool at or near points of origin may be influenced mainly by technical requirements for adequate preparation, conditions under which the wool is handled and processed, and the methods and practices involved at each stage in marketing. Wool that is to be used in the manufacture of specialized yarns and fabrics should be prepared to meet the particular requirements for these products. The degree to which it would be advantageous to prepare wool at or near the ranch to meet such specialized needs would depend upon the availability of personnel trained in the specialized needs of manufacturers and of adequate facilities and equipment for effective preparation, and upon the influence of such preparation on costs of marketing and processing. Manufacturers select and blend wools according to the type of fabrics they make.

Policies with regard to imports, labeling, prices, and other programs relating to the wool industry have emphasized protective measures for domestic wool. They have, perhaps, given too little consideration to the benefits that may come from encouraging growers to prepare and market their wool in a way that would strengthen its competitive position. Import tariffs are designed to protect domestic wool from competition of foreign wool and the Labeling Act was designed to protect wool from competition of other fibers. Benefits to domestic producers from price supports and from protective measures may be supplemented by strengthening the competitive position of domestic wool through improvements in quality, preparation, and marketing.

Feasible means for strengthening the competitive position of our wool would need to take into account differences between domestic and foreign-grown wools, influences of technological developments, and the growing competition of manmade fibers. Large quantities of the wool produced in Western States and in Texas meet requirements as to fiber length and fineness for use in the manufacture of worsteds, but ranch preparation of this wool usually is poor in comparison with that of most imported wools. Although the prices of imported wools are usually higher than those of domestic wools, reflecting the differences in quality and preparation, consumption of imported wools in this country in recent years has increased markedly in relation to that of domestic wool.

The competitive position of poorly prepared wool has been weakened in recent years as a result of technological and other developments in the wool-manufacturing industry. These developments were associated with large increases in costs of labor and the development of automatic machinery for use in reducing these costs. Use of high-speed and more automatic machinery and improved methods requires uniform fibers for most efficient operation. As a result, the disadvantages of poorly prepared wools or other fibers are aggravated because manufacturers prefer wool that meets the requirements of the more automatic machinery and improved methods used.

Further expansions in production and improvements in quality of manmade fibers may affect materially the competitive position of wool. Some of these fibers apparently compete directly with wool. They are delivered to textile mills in good condition for manufacturing operations. Their uniformity and freedom from defects tend to reduce the cost of making fabrics. New developments in high-speed manufacturing machinery place an increasing premium on these advantages. Consequently, poorly prepared wools, which lack this uniformity and require much manual handling in preparation, are placed at an increasing disadvantage.

Possibilities for more thorough preparation of wool in producing areas to strengthen its competitive position and to increase incomes to producers, from the viewpoint of growers, would depend upon whether the additional costs of improved preparation would be at least offset by higher prices received as a result of such improvements. The feasibility of such improvements may depend mainly upon the influence of particular kinds of preparation in producing areas, instead of at eastern manufacturing centers, on the quality and costs

of preparation, on costs of marketing and processing, and on the acceptability of the product to handlers and manufacturers.

Factors that affect the quality and costs of preparing wool in producing areas include size of flocks or quantity of wool at individual farms or ranches, facilities and personnel available, and knowledge of mill requirements. Although many farm flocks are small, substantial quantities of the wool produced in Western States and in Texas come from ranches on which the quantity of wool produced is large enough for at least fairly effective utilization of the facilities and personnel required for improved preparation of wool. Facilities and equipment required for improved preparation are not great and the per unit cost of providing them, especially for the larger ranches, would be low. The problem of providing adequate personnel who know the techniques of preparation and the requirements of mills may be difficult. It may require provisions for training additional personnel and for their supervision.

Cost data for ranch preparation of wool are limited. Those available indicate that, for the larger clips at least, costs of grading and skirting wool at the ranch would be less than either average differences between prices of poorly prepared and of well-prepared wools in central markets or the reduction in central market costs that could result from ranch preparation. These differences suggest that returns to wool growers might be increased by improved preparation of the large clips at the ranch. Possibilities for such gains appear to be limited mainly to the Western States and Texas, where most of the larger flocks are found. Such benefits from improved preparation at the larger ranches and at western warehouses would hinge upon the dependability of the preparations and upon the willingness of marketers and manufacturers to accept them.

Preferences expressed by dealers, topmakers, and manufacturers in the Boston area with regard to the preparation of wool show that all manufacturers who use domestic grease wool would prefer to buy Territory wool prepared as are Australian wools. None preferred to have Territory wool skirted by western growers, about half favored grading of this wool by growers, and all preferred to have it more effectively tagged by growers. Most of the topmakers interviewed preferred to buy Territory wool ungraded and unskirted. Some preferred to buy wool in a fairly narrow graded line. The few dealers and commission agents who were interviewed said they preferred ungraded or orginal bag wool.

These preferences are influenced by several factors and they have important implications. Customs and habits, growing out of experience in dealing with problems of the industry, tend to fix preferences in a rigid pattern that resists change. Preferences of manufacturers may reflect mainly the requirements of processors and only indirectly the effectiveness of ranch preparation in meeting them. Dealers and some topmakers prefer unprepared wool because they believe they can buy and prepare it for manufacturers more satisfactorily and at lower cost than they could buy similar wool graded and skirted on the ranch. These attitudes may limit the possibilities for effective ranch preparation. They will need to be modified or their restricting influences reduced if the competitive position of wool is to be improved and returns to growers increased through improved preparation of wool on the ranch.

A significant contribution toward improving the adequacy and acceptability of ranch preparation of wool might be made by increased coordination of grower activities, both in preparation and in selling, to obtain the market value added by ranch preparation. If ranch preparation is to meet the standards of quality and uniformity required by manufacturers, skirting and grading on the ranch must be made both adequate and consistent among growers. Uniform standards for use as a guide in grading and skirting may need to be developed. Provision may need to be made for supervision of grading and skirting by a competent and unbiased agency to assure buyers and others that the quality and uniformity of ranch preparation are dependable.

Acceptability of ranch preparation of wool rests mainly in the hands of dealers, commission agents, and topmakers, most of whom are opposed to the grading and skirting of Territory wool by growers. These firms are in a strong position to make their preferences effective in the market because they buy most of the wool from producers and prepare or process it for manufacturers, who are mainly concerned with receiving well-prepared wool, regardless of where or by whom it is prepared. Consequently, the value added by ranch grading and skirting of wool may not be reflected in relatively higher prices to growers unless the quality and dependability of ranch preparation is such that the wool thus prepared will be readily accepted by dealers, commission agents, and topmakers.

In Australia and New Zealand the broker and auction systems are used to assure that ranch preparation meets standard requirements. The technique used to coordinate ranch preparation is simple. It requires only that the technicians who supervise skirting and grading on ranches be approved by the brokers' association. This ensures both adequate and uniform preparation.[2] If auctions were more common in the Western States and in Texas the same methods might be used. But other agencies might be used for the same purpose.

Coordination required for assuring adequate preparation of domestic wool might be developed through one or more of a number of agencies. The necessary arrangements might be worked through growers' organizations, including grower cooperatives; operators of warehouses; representatives of dealers, processors, or manufacturers; or some combinations of these agencies. Basic requirements would be that the agency or agencies responsible for preparation be competent, that the volume of wool prepared be large enough to assure uniform preparation and efficient operation, and that the individuals actually doing the work have the confidence of both the producers and the trade.

To make coordination effective in meeting the standards of quality and uniformity required by dealers or manufacturers, some means may need to be developed for assuring that preparation of wool at or near the ranch is both adequate and consistent. This may require, in addition to competent agencies for preparing the wool, supervision by some competent and unbiased agency to assure buyers and others that the quality of preparation is both uniform and dependable.

[2] The penalty for a grower's failure to meet the standards is his exclusion from the wool auction. As auctions form the major outlet for these wools, this penalty is effective.

Methods for enabling growers to obtain the market value added by ranch preparation may include coordination in selling wool. This coordination might be effected through warehouse operators in Western States and Texas, through grower cooperatives, or through other agencies. A few large auctions might be organized by these agencies for use in selling the wool. Auctions bring together a number of competing buyers and through them growers may obtain the full value of ranch preparation. Cooperative selling by pooling, or on a consignment basis, may be used to advantage, but, for best results, the volumes handled by cooperatives would need to be increased. Regardless of the alternative used, support by growers would be needed.

Expanded services from public agencies would be needed to establish and maintain an effective plan for adequate ranch preparation of wool. Work designed to develop and establish comprehensive standards for the quality elements of wool would need to be continued to provide a guide in assorting wool. A dependable grading service to growers based on adequate standards would facilitate the selling of wool on the basis of quality. Educational efforts might be needed to advise growers regarding the requirements for adequate ranch preparation, to train technical workers to grade and skirt or to supervise the grading and skirting of wool in producing areas, and to help growers coordinate their operations so as to realize the full benefits of adequate ranch preparation.

INTRODUCTION

Wool produced in the United States is confronted with greatly increased competition from well-prepared imported wools and from manmade fibers. In recent years, production of domestic wool has declined until it is now low in relation to possible military and civilian needs, to production of wool in other countries, and to production of manmade fibers. In addition, the quality of domestic wool is less uniform than that of competing fibers. These developments and differences have stimulated Federal, State and other agencies to explore the possibilities of improving the preparation and marketing of domestic wool so that its competitive position may be strengthened and the incomes of wool growers increased.

Wool, as it comes from sheep, varies considerably in fineness, length, and other elements of quality[3] from one fleece to another, with differences in breed and other factors, and from one part of the fleece to another. For most effective use by manufacturers, the fleeces and the wool in individual fleeces must be separated on the basis of differences in quality. The separated portions must then be combined into lots of uniform quality. These and supplementary operations are referred to in this bulletin as preparation.

Wool produced in this country usually is not adequately skirted at the farm or ranch and most of it is not well graded before it arrives at central markets. The central purpose of the study reported here was to contribute to an understanding of the extent to which, and the conditions under which, Territory wool can feasibly be skirted, graded, and otherwise adequately prepared at or near the ranch on

[3] The term, "quality," as used in this bulletin, refers to all elements of wool that affect its usefulness.

which it is produced, in accordance with the requirements of dealers, processors, and manufacturers.

This report relates mainly to the economic aspects of improving the marketing of wool by additional preparation in wool-producing areas of the West. It is based mainly on data assembled in the Boston area, and includes information obtained from dealers or handlers, processors, manufacturers, and distributors in that area. The results are intended to supplement information relating to preparation, processing, and marketing wool assembled in producing areas by eight State agricultural experiment stations in Western States and Texas (*37*).[1]

Information intended to show the relation of preparation of wool to the wool industry in this country and to the competitive position of domestic wool is presented. It is expected to serve as a background for an understanding of the importance of adequate preparation and for appraising the feasibility of expanding the preparation of western wool in or near producing areas.

A glossary of technical terms used in the wool industry may be found on page 85.

RELATION OF PREPARATION TO THE WOOL INDUSTRY

Conditions under which wool is produced, marketed, and manufactured, and the personnel and facilities available at the different stages in the movement of wool from farms and ranches to mills, must be taken into account in ascertaining where and under what conditions wool can be prepared most effectively and economically. Information for use in this connection would need to show developments, present practices, and prospective trends in the production, handling, and marketing of wool and in the processing and manufacture of the products made from wool. Some of the information needed is presented in this section of this bulletin.

Production of Wool

The feasibility of preparing wool at or near points of origin may be greatly influenced by the location and characteristics of wool production in this country, by trends and prospects in the wool industry, and by the quality of wool produced as influenced by the values of wool relative to the values of the carcasses of sheep and lambs for meat.

LOCATION AND CHARACTERISTICS

Some wool is produced in most countries of the world. The 11 largest producing countries in order are: Australia, Argentina, New Zealand, Soviet Union, United States, British South Africa, Uruguay, Spain, United Kingdom, China, and Turkey. In 1952, the combined output of these countries accounted for more than four-fifths of the world total (tables 1 and 2). The proportion of the world total accounted for by production in the United States decreased from an average of 10.8 percent from 1936 to 1940 to 6.2 percent in the early 1950's. In 1952, it was 6.2 percent.

[1] Italic figures in parentheses refer to Literature Cited, p. 82.

TABLE 1.—*Wool production in specified countries, greasy basis, averages 1936–40 and 1946–50; annual 1947–52* [1]

Country	Averages		1947	1948	1949	1950	1951 [2]	1952 [2]
	1936–40	1946–50						
	Million pounds	*Million pounds*	*Million pounds*	*Million pounds*	*Million pounds*	*Million pounds*	*Million pounds*	*Million pounds*
Estimated world total	3, 930	3, 900	3, 710	3, 770	3, 880	3, 940	4, 030	4, 170
Australia	1, 052	1, 050	973	1, 031	1, 110	1, 092	1, 098	1, 160
Argentina	411	450	475	419	420	420	430	420
New Zealand	314	372	362	367	390	390	407	415
Soviet Union [3]	310	304	286	305	315	325	335	370
United States	425	285	309	278	248	248	250	260
Union of South Africa [4]	252	216	205	219	218	228	245	240
Uruguay	126	163	150	144	163	181	187	195
Spain	70	83	77	88	82	90	90	93
United Kingdom	110	81	72	81	88	89	88	90
China [3]	88	75	75	75	75	75	75	75
Turkey	68	71	71	76	71	67	73	75
India [5]	73	52	54	53	46	50	52	58
Brazil	36	46	43	45	48	47	52	53
Chile	33	42	42	42	46	42	44	44
France	37	31	29	29	34	35	40	40
French Morocco	35	27	25	28	30	33	35	40
Iran	36	29	30	30	25	33	34	37
Italy	30	30	27	29	35	35	36	35
All other	424	493	405	431	436	460	459	470

[1] Data for wool produced mostly in spring in the Northern Hemisphere are combined with those for wool produced in the season beginning July 1 or October 1 of the same year in the Southern Hemisphere.

[2] Preliminary.

[3] Based on boundaries in 1952 and on number of sheep and average fleece weight of 4.7 pounds per head.

[4] Union of South Africa, Union Protectorates, and Southwestern Africa.

[5] Includes Pakistan.

Adapted from Foreign Crops and Markets (*44*).

TABLE 2.—*Wool production in specified countries as proportion of world total, averages 1936–40 and 1946–50; annual 1947–52* [1]

Country	Averages		1947	1948	1949	1950	1951 [2]	1952 [2]
	1936–40	1946–50						
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Estimated world total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Australia	26. 8	26. 9	26. 2	27. 4	28. 6	27. 7	27. 2	27. 8
Argentina	10. 5	11. 5	12. 8	11. 1	10. 8	10. 7	10. 7	10. 1
New Zealand	8. 0	9. 5	9. 8	9. 7	10. 1	9. 9	10. 1	9. 9
Soviet Union [3]	7. 9	7. 8	7. 7	8. 1	8. 1	8. 2	8. 3	8. 9
United States	10. 8	7. 3	8. 3	7. 4	6. 4	6. 3	6. 2	6. 2
Union of South Africa [4]	6. 4	5. 6	5. 5	5. 8	5. 6	5. 8	6. 1	5. 7
Uruguay	3. 2	4. 2	4. 1	3. 8	4. 2	4. 6	4. 6	4. 7
Spain	1. 8	2. 1	2. 1	2. 3	2. 1	2. 3	2. 2	2. 2
United Kingdom	2. 8	2. 1	1. 9	2. 2	2. 3	2. 2	2. 2	2. 2
China [3]	2. 2	1. 9	2. 0	2. 0	1. 9	1. 9	1. 9	1. 8
Turkey	1. 7	1. 8	1. 9	2. 0	1. 8	1. 7	1. 8	1. 8
India [5]	1. 9	1. 3	1. 5	1. 4	1. 2	1. 3	1. 3	1. 4
Brazil	. 9	1. 2	1. 2	1. 2	1. 2	1. 2	1. 3	1. 3
Chile	. 8	1. 1	1. 1	1. 1	1. 2	1. 1	1. 1	1. 0
France	. 9	. 8	. 8	. 8	. 9	. 9	1. 0	1. 0
French Morocco	. 9	. 7	. 7	. 7	. 8	. 8	. 9	1. 0
Iran	. 9	. 8	. 8	. 8	. 7	. 8	. 8	. 9
Italy	. 8	. 8	. 7	. 8	. 9	. 9	. 9	. 8
All other	10. 8	12. 6	10. 9	11. 4	11. 2	11. 7	11. 4	11. 3

[1] Data for wool produced mostly in spring in the Northern Hemisphere are combined with those for wool produced in the season beginning July 1 or October 1 of the same year in the Southern Hemisphere.
[2] Preliminary.
[3] Based on boundaries in 1952 and on number of sheep and average fleece weight of 4.7 pounds per head.
[4] Union of South Africa, Union Protectorates, and Southwestern Africa.
[5] Includes Pakistan.

Adapted from Foreign Crops and Markets (44).

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Annual world production of wool increased from less than 3 billion pounds, grease basis, in 1920 to 4.2 billion pounds in 1941; decreased to less than 3.8 billion pounds during the middle forties; and increased to more than 4 billion pounds in the early fifties. After reaching a peak of more than 450 million pounds during the early forties, production in this country decreased to less than 250 million pounds in the early fifties, and totaled 260 million pounds in 1952. Substantial increases in production of wool since World War II are indicated in Australia, New Zealand, Soviet Union, Union of South Africa, Uruguay, and in a number of smaller countries (table 1).

Most of the wool produced in the United States is obtained by shearing live sheep and is known as shorn wool. Considerable quantities are obtained by pulling wool from skins of slaughtered sheep. This is known as pulled wool. Smaller quantities are obtained by detaching the wool from carcasses of sheep which have died on the range or farm and are known as "murrain" wool. From 1946 to 1950, about 84 percent of the wool produced here was shorn, about 16 percent was pulled, and less than 1 percent was murrain wool.

Production of wool is widely distributed throughout the United States. In 1952, each State produced some wool and the quantity of shorn wool ranged from a few thousand pounds in some States to more than 50 million pounds in Texas. The 10 largest wool-producing States in that year, in order, were: Texas, Wyoming, California, Montana, Utah, Colorado, New Mexico, Idaho, Ohio, and South Dakota. Production in these 10 States made up about 69 percent of the total for the United States. Pulled wool is produced mainly in large slaughtering and meatpacking plants at such centers as Chicago, San Francisco, New York, and Philadelphia. But considerable quantities are produced in independent wool pulleries in various parts of the country. Reports indicate that in 1952 about 15 wool pulleries, independent of major slaughtering and meatpacking plants, were located in 11 States, ranging from Massachusetts to California.[5]

A substantial part of the wool produced in this country comes from small flocks. In 1949, for example, more than 96 percent of the farms that reported sheep and lambs shorn reported fewer than 300, and more than 98 percent reported fewer than 1,000 sheep and lambs shorn that year. About 38 percent of the sheep and lambs shorn that year were on farms reporting fewer than 300, and more than half were on farms reporting fewer than 1,000. Similar data for the 11 Western States and Texas, show that about 82 percent of the farms reported fewer than 300, and 92 percent reported fewer than 1,000 sheep and lambs shorn. The proportions of the total number of sheep and lambs shorn in this area that were accounted for by these farms were about 15 and 32 percent, respectively (tables 3 and 4). The many small flocks may be important in determining the feasibility of preparing wool on farms or ranches.

TRENDS AND PROSPECTS

Numbers of sheep and lambs on farms and production of wool in the United States decreased markedly in the 1940's but some increases in

[5] Data assembled by Bureau of Agricultural Economics.

the early 1950's are indicated. Total numbers of sheep and lambs on January 1 decreased from 56.2 million in 1942 to 29.8 million in 1950, then increased to 32.1 million in 1952. Further increases are anticipated. In the 11 Western States and Texas, the number of stock sheep on farms on January 1 decreased from 32.4 million in 1942 to 18.5 million in 1950, then increased to 20.1 million in 1952. Further increases are indicated. Similar trends are indicated for the total of all other States (*40*).

TABLE 3.—*Farms reporting and sheep and lambs shorn, by specified number shorn per farm, United States, and 11 Western States and Texas, 1949*

Number of sheep and lambs shorn per farm	United States		11 Western States and Texas		All other States	
	Farms reporting	Sheep and lambs shorn	Farms reporting	Sheep and lambs shorn	Farms reporting	Sheep and lambs shorn
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
Total	285, 534	22, 442, 703	49, 182	15, 251, 681	236, 352	7, 191, 022
Under 25	170, 912	1, 981, 297	18, 293	186, 145	152, 619	1, 795, 152
25–49	60, 022	2, 019, 352	7, 095	245, 348	52, 927	1, 774, 004
50–99	28, 420	1, 865, 625	6, 809	462, 962	21, 611	1, 402, 663
100–299	15, 769	2, 458, 838	8, 095	1, 332, 617	7, 674	1, 126, 221
300–599	4, 277	1, 702, 903	3, 281	1, 312, 332	996	390, 571
600–999	2, 004	1, 501, 049	1, 7' 8	1, 299, 017	276	202, 032
1,000–2,499	2, 790	4, 239, 314	2, 575	3, 936, 013	215	303, 301
2,500 and over	1, 340	6, 674, 325	1, 306	6, 477, 247	34	197, 078
	Percentage of total					
Total	*Percent* 100. 0	*Percent* 100. 0	*Percent* 100. 0	*Percent* 100. 0	*Percent* 100. 0	*Percent* 100. 0
Under 25	59. 9	8. 8	37. 2	1. 2	64. 6	25. 0
25–49	21. 0	9. 0	14. 4	1. 6	22. 4	24. 7
50–99	10. 0	8. 3	13. 8	3. 0	9. 1	19. 5
100–299	5. 5	11. 0	16. 5	8. 8	3. 3	15. 7
300–599	1. 5	7. 6	6. 7	8. 6	. 4	5. 4
600–999	. 7	6. 7	3. 5	8. 5	. 1	2. 8
1,000–2,499	1. 0	18. 9	5. 2	25. 8	. 1	4. 2
2,500 and over	. 4	29. 7	2. 7	42. 5	(1)	2. 7

[1] Less than 0.05 percent.

Adapted from reports of Bureau of the Census.

TABLE 4.—*Farms reporting and sheep and lambs, April 1, classified by number of sheep and lambs shorn, by area, United States, 1950*

Number of sheep and lambs shorn per farm	United States		11 Western States and Texas		All other States	
	Farms reporting	All sheep and lambs	Farms reporting	All sheep and lambs	Farms reporting	All sheep and lambs
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
Total	320, 314	31, 386, 801	63, 160	20, 511, 808	257, 154	10, 874, 993
Under 25	155, 354	3, 479, 074	16, 926	382, 235	138, 428	3, 096, 839
25–49	55, 869	3, 228, 233	6, 599	437, 529	49, 270	2, 790, 704
50–99	26, 705	2, 814, 045	6, 408	766, 932	20, 297	2, 047, 113
100–299	14, 649	3, 335, 153	7, 650	1, 953, 477	6, 999	1, 381, 676
300–599	3, 977	2, 141, 811	3, 147	1, 794, 335	830	347, 476
600–999	1, 908	1, 867, 945	1, 672	1, 690, 548	236	177, 397
1,000–2,499	2, 711	5, 342, 267	2, 514	5, 073, 958	197	268, 309
2,500 and over	1, 307	7, 645, 259	1, 278	7, 528, 220	29	117, 039
No sheep shorn	57, 834	1, 533, 014	16, 966	884, 574	40, 868	648, 440
	Percentage of total					
Total	*Percent* 100. 0	*Percent* 100. 0	*Percent* 100. 0	*Percent* 100. 0	*Percent* 100. 0	*Percent* 100. 0
Under 25	48. 5	11. 1	26. 8	1. 9	53. 8	28. 5
25–49	17. 4	10. 3	10. 5	2. 1	19. 2	25. 6
50–99	8. 3	9. 0	10. 1	3. 7	7. 9	18. 8
100–299	4. 6	10. 6	12. 1	9. 5	2. 7	12. 7
300–599	1. 2	6. 8	5. 0	8. 8	. 3	3. 2
600–999	. 6	5. 9	2. 6	8. 3	. 1	1. 6
1,000–2,499	. 9	17. 0	4. 0	24. 7	. 1	2. 5
2,500 and over	. 4	24. 4	2. 0	36. 7	(1)	1. 1
No sheep shorn	18. 1	4. 9	26. 9	4. 3	15. 9	6. 0

[1] Less than 0.05 percent.

Adapted from reports of the Bureau of the Census

Factors responsible for declines in numbers of sheep during recent years include scarcity of dependable help and increased costs of labor, losses from predatory animals, reduction in grazing allotments on public land, and relatively low returns from sheep (*48*). Sheep compete with cattle for available range pasture and other feeds, and during much of the time since 1900 in the 11 Western States the trends in numbers of stock sheep and cattle on farms have moved in the opposite direction (fig. 1). The sharp reduction in numbers of sheep that occurred during the 1940's was associated with above-average ratios of the unit value of cattle to sheep. The trend in total numbers of sheep in native sheep States has fluctuated widely and irregularly in relation to the trend in cattle numbers since 1900, but the long-time trend in numbers of sheep is downward and that for cattle is upward (fig. 2).

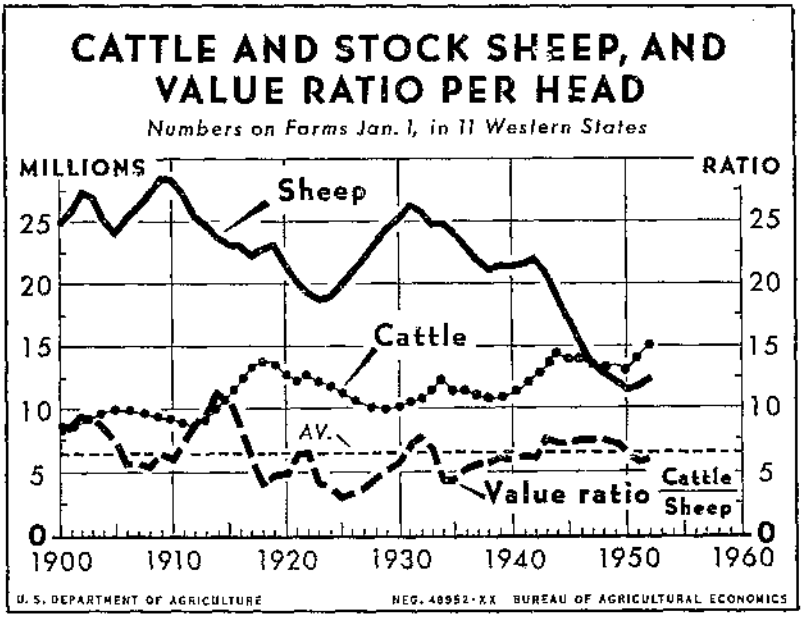

FIGURE 1.—Numbers of sheep in the 11 Western States have fluctuated considerably since 1900, but the long-time trend for sheep is downward and that for cattle is upward. The sharp reduction in numbers of sheep during the 1940's was associated with above-average ratios of unit value of cattle to sheep.

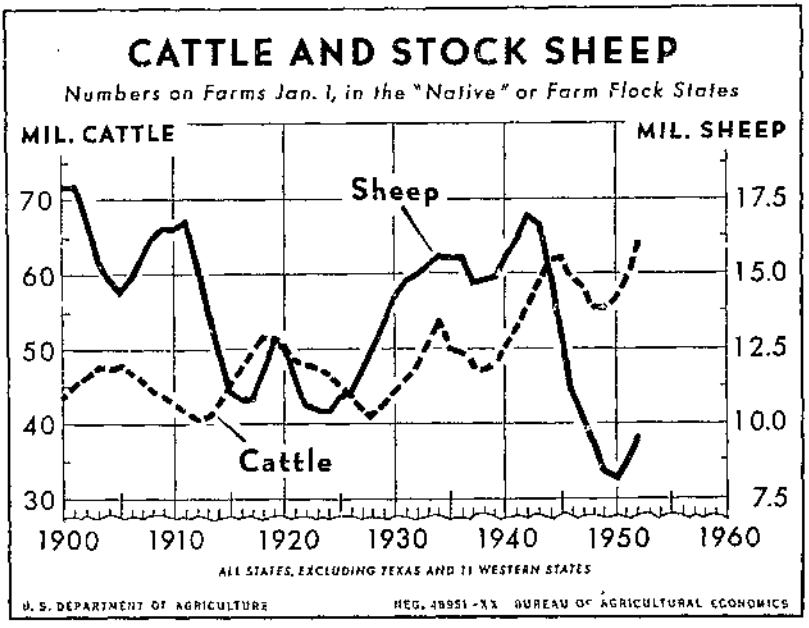

FIGURE 2.—In "native" or farm-flock States, numbers of sheep have fluctuated widely and numbers of cattle have fluctuated considerably since 1900. The long-time trend for sheep is irregularly downward and that for cattle is distinctly upward.

Annual production of shorn wool in this country decreased from 388.3 million pounds, grease basis, in 1942 to 212.9 million in 1949, then increased to 232.4 million pounds in 1952. The decrease from 1942 to 1949 was less, proportionally, in the 11 Western States and Texas than in other regions (*48*). Corresponding data for pulled wool show a decrease in production from 73.5 million pounds in 1944 to 52.4 million pounds in 1950 and an increase to 33.6 million pounds in 1952 (*40*). The proportion of the shorn wool produced on farms with fewer than 300 sheep and lambs shorn decreased from about 39 percent in 1939 to 36 percent in 1949. The proportion produced on farms with fewer than 600 sheep and lambs shorn decreased from 46 percent in 1939 to 43 percent in 1949, according to Census reports.

WOOL VERSUS MEAT

Wool is a joint product with meat—lamb and mutton—and the quality and quantity of wool produced may be greatly influenced over long periods by the relative importance of these products as sources of farm income. In early days, wool was the principal product of the sheep industry, but in more recent years the relative importance of wool and of lamb and mutton as sources of farm income has varied considerably from one area to another. For the country as a whole, the proportion of wool growers' income derived from shorn wool decreased from an average of about 42 percent from 1910 to 1919 to an average of about 35 percent during the 1940's. A low point of about 25 percent was reached in 1947; in 1952 it was 39 percent (*41*). The proportion of wool growers' income derived from shorn and pulled wool decreased from an average of about 55 percent from 1910 to 1919 to an average of 46 percent during the 1940's and a low point of 36.5 percent was reached in 1947 (*41*).

When wool was the main source of income, relatively large numbers of wether sheep were kept and lambs were raised mainly to replace sheep lost by death and the comparatively few sold for slaughter (*48*). In more recent years, with increases in the relative importance of lambs for slaughter, the emphasis in sheep raising has shifted from production of fine wool breeds to the meat types or crossbreeds. Joint returns from the better meat but coarser wool animals in many areas have been greater than those from the finer wool but poorer meat types. Shifts in response to these differences have resulted in reductions in both the quality and quantity of shorn wool produced.

Public Policy Relating to Imports and Marketing

The marketing of wool produced in this country, including its preparation and processing, may be influenced considerably by policies with regard to imports of wool, the labeling of products made from wool, price supports, and other programs relating to the wool industry. Any adverse effects that these policies may have on ranch preparation of domestic wool may be attributed mainly to attempts to protect domestic wool from the competition of wool from countries where costs of production are relatively low. Information with regard to these policies, as presented in this bulletin, is limited mainly to the

phases that influence, either directly or indirectly, the preparation and marketing of our wool.

TARIFFS

Import tariffs are probably the most effective means of protecting domestic wool from the competition of foreign-produced wool. During most of the time since 1816, tariffs imposed on wool imported into this country have effectively restricted imports (table 5). From 1930 to 1948, an import duty of 34 cents a pound, clean content, was maintained, but in July 1948, the rate was reduced to 25.5 cents a clean pound. This reduction was made to conform to the Geneva Agreement on Tariffs and Trade signed the previous year.[6] This tariff strengthened the position of domestic wool in competition with well-prepared wool produced in foreign countries. Until recently, the rates were effective in maintaining prices to domestic growers that were high in relation to world prices, regardless of the quality and preparation of domestic wool.

TABLE 5.—*Rates of duty on wool imports under the tariff acts, 1789–1948*

Date of act	Effective date	Rate of duty
1789–1816		Free.
Apr. 27, 1816	July 1, 1816	First act. 15 percent ad valorem.
May 22, 1824	July 1, 1824	Value of 10 cents a pound or less, 15 percent; other wool, 20 percent until July 1, 1825; 25 percent until June 1, 1826; 30 percent thereafter.
May 19, 1828	Sept. 2, 1828	4 cents a pound plus 40 percent to June 30, 1829; plus 45 percent to June 30, 1830; plus 50 percent thereafter.
July 14, 1832	Mar. 4, 1833	Value of 8 cents a pound or less, free; other wool, 4 cents a pound plus 40 percent.
Mar. 2, 1833	Jan. 1, 1834	Duties exceeding 20 percent to be reduced to 20 percent by yearly reductions to July 1, 1842.
Sept. 11, 1841	Oct. 1, 1841	All rates below 20 percent to be 20 percent.
Aug. 30, 1842	Aug. 31, 1842	Value of 7 cents a pound or less, 5 percent; other wool, 3 cents a pound plus 30 percent.
July 30, 1846	Dec. 2, 1846	30 percent.
Mar. 3, 1857	July 1, 1857	Valued at 20 cents a pound or less free. All other, 24 percent.
Mar. 2, 1861	Apr. 2, 1861	Value of 18 cents a pound or less, 5 percent; value over 18 cents to 24 cents, 3 cents a pound; value over 24 cents, 9 cents a pound.
June 30, 1864	July 1, 1864	Value of 12 cents a pound or less, 3 cents a pound; value over 12 cents to 24 cents, 6 cents a pound, value over 24 cents to 32 cents, 10 cents a pound, plus 10 percent; value over 32 cents, 12 cents a pound plus 10 percent. Scoured wool, three times these rates.

[6] This rate applies to "most favored" nations exporting wool to the United States.

TABLE 5.—*Rates of duty on wool imports under the tariff acts, 1789–1948*—Continued

Date of act	Effective date	Rate of duty
Mar. 2, 1867	Mar. 3, 1867	Class 1 (clothing wool), value of 32 cents a pound or less, 10 cents a pound plus 11 percent; value over 32 cents, 12 cents a pound plus 10 percent. Class 2 (combing wool), value of 32 cents a pound or less, 10 cents a pound plus 11 percent; value over 32 cents, 12 cents a pound plus 10 percent. Class 3 (carpet wools), value of 12 cents a pound or less, 3 cents a pound; value over 12 cents, 6 cents a pound. Washed, class 1, twice these rates; scoured, all classes, three times these rates.
June 6, 1872	Aug. 1, 1872	All wools, 10-percent reduction of former rates.
Mar. 3, 1875	Mar. 4, 1875	10-percent reduction of June 6, 1872, repealed.
Mar. 3, 1883	July 1, 1883	Class 1, value of 30 cents a pound or less, 10 cents a pound, value over 30 cents, 12 cents a pound. Class 2, value of 30 cents a pound or less, 10 cents a pound; value over 30 cents, 12 cents a pound. Class 3, value of 12 cents a pound or less, 2½ cents a pound; value over 12 cents, 5 cents a pound. Washed, class 1, twice these rates; scoured, all classes, three times these rates.
Oct. 1, 1890	Oct. 6, 1890	Class 1, 11 cents a pound. Class 2, 12 cents a pound. Class 3, value of 13 cents a pound or less, 32 percent; value over 13 cents, 50 percent. Washed, class 1, twice this rate, scoured, classes 1 and 2, three times these rates.
Aug. 27, 1894	Aug. 1, 1894	Free.
July 24, 1897	July 24, 1897	Class 1, 11 cents a pound. Class 2, 12 cents a pound. Class 3, value of 12 cents a pound or less, 4 cents a pound; value over 12 cents, 7 cents a pound. Washed, class 1, twice this rate, scoured, classes 1 and 2, three times these rates; fit for carding or spinning, class 3, three times these rates.
Aug. 5, 1909	Aug. 6, 1909	Class 1, 11 cents a pound. Class 2, 12 cents a pound. Class 3, value of 12 cents a pound or less, 4 cents a pound; value over 12 cents, 7 cents a pound. Washed, class 1, twice this rate; scoured, classes 1 and 2, three times these rates; fit for carding or spinning, class 3, three times these rates. Foregoing rates are the minimum tariff. The maximum tariff is 25 percent higher and is to be in force to March 31, 1910, and thereafter, unless the President by proclamation declares no discrimination by particular countries.
Oct. 3, 1913	Dec. 1, 1913	Free.
May 27, 1921	May 28, 1921	Clothing wool, unwashed, 15 cents a pound; washed, 30 cents a pound; scoured, 45 cents a pound.

TABLE 5.—*Rates of duty on wool imports under the tariff acts, 1789–1948*—Continued

Date of act	Effective date	Rate of duty
Sept. 21, 1922	Sept. 22, 1922	Wool not improved by admixture with Merino or English blood, in the grease, 12 cents a pound; washed, 18 cents a pound; scoured, 24 cents a pound. If used for carpets, rugs, or other floor coverings, duty refunded. Other wool, in the grease or washed, 31 cents a pound of clean content; scoured, 31 cents a pound. (All rates subject to change by President after investigation of costs of production, domestic and foreign.)
Act of 1930		Wool not improved by admixture with Merino or English blood, in the grease, 24 cents a pound; washed 24 cents a pound; scoured, 27 cents a pound. If used for carpets, rugs, or other floor coverings, free or duty refunded. Other wool, finer than 44's, in the grease or washed, 34 cents a pound of clean content; scoured, 37 cents a pound. Other wool, finer than 40's but not finer than 44's, in the grease or washed, 29 cents a pound; scoured, 32 cents a pound.
1945 [1]		Wool not improved by admixture with Merino or English blood, in the grease, 13 cents a pound; washed 13 cents a pound; scoured, 16 cents a pound. If used for carpets, rugs, or other floor coverings, free or duty refunded. Other wool, finer than 44's in the grease or washed, 34 cents a pound of clean content; scoured, 37 cents a pound. Other wool, finer than 40's but not finer than 44's, in the grease or washed, 17 cents a pound, scoured, 20 cents a pound.
1948 [2]		Wool not improved by admixture with Merino or English blood, in the grease, 13 cents a pound; washed, 13 cents a pound; scoured, 16 cents a pound. If used for carpets, rugs, or other floor coverings, free or duty refunded. Other wool, finer than 44's, in the grease or washed, 25½ cents a pound of clean content; scoured, 37¾ cents a pound. Other wool, finer than 40's but not finer than 44's, in the grease or washed, 17 cents a pound; scoured, 20 cents a pound.

[1] Trade agreement with Argentina, effective November 1941, and with Uruguay, effective January 1943.

[2] Bound, Geneva, 1948; commitment not made effective on January 1, 1948, pursuant to article 27 of the Geneva Agreement, but became effective July 31, 1948.

Rates from 1789 to 1922 adapted from U. S. Department of Agriculture Yearbook 1923, (*45, p. 805*); others adapted from United States Tariff Commission, *Summaries of Tariff Information, Vol. 2,—Wool and Manufactures, Part 1,—Raw Wool and Related Hair* (*51*).

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Under these conditions, the advantages to growers of improving preparation apparently were overshadowed by the gains from protective tariffs. Grower returns were increased a great deal more as a result of tariffs than they could have been increased by adequate preparation of their wool. It is not surprising that domestic growers have looked to tariffs for protection instead of trying to improve their competitive position by adequately preparing their wool. But our tariffs doubtless stimulated the preparation of imported wools as a means of strengthening their competitive position.[1] Any advantages of preparing domestic wool at or near points of origin, however, would supplement the influence of tariffs in strengthening the competitive position of this wool.

WOOL LABELING

The Wool Labeling Act of 1939, as well as import tariffs, may have helped to divert the attention of domestic wool growers from the advantages of adequately preparing their wool. Import tariffs, as previously indicated, protect domestic wool producers to some extent from the competition of foreign wool. The Labeling Act was designed to protect wool from the competition of other fibers, including reclaimed wool, by identifying the fibers contained in fabrics by means of labels. Under this act all products containing, purporting to contain, or in any way represented as containing wool or reprocessed or reused wool must be labeled (*46*). The label must show the percentage of the total fiber weight represented by each kind of wool and also the percentage of cotton and other fibers present, if any.

Although the protection desired by wool growers and that desired by wool manufacturers differed somewhat, support for the Wool Products Labeling Act of 1939 was obtained from both groups. Wool growers were primarily concerned with inroads made on their market by reclaimed wool, whereas manufacturers were mainly concerned with protecting their products from the increasing competition of rayon. Use of reworked and reprocessed wools in the manufacture of wool fabrics apparently strengthens the position of wool products in competition with synthetic fibers (*10*). Some wool manufacturers have opposed those provisions of the Wool Labeling Act that relate to reworked and reprocessed wools. They believe that these provisions restrict the scope of their promotional activities (*10*).

Representative of wool growers' organizations stress the benefits of the Wool Labeling Act to domestic growers, but the extent of such benefits may be overestimated. Benefits from the labeling provisions relating to reworked and reprocessed wool go mainly to the manufacturers who produce and advertise "100 percent virgin wool" fabrics. A relatively few large firms specialize in the manufacture of these high-quality fabrics. Unfortunately for our wool growers, they use

[1] This was partly because only well-prepared wool could meet the competition of domestic wools protected by high tariffs, but mainly because duties were levied on the actual weight, including grease and dirt, of the imports up to 1922. Well-skirted fleeces, with the heavily shrinking parts removed, contained more wool per pound, grease weight, than unskirted fleeces. A duty on the grease weight thus gave these fleeces a considerable advantage. Since the Tariff Act of 1922 became effective, the duty has been applied against the clean content. By that time, however, expert skirting and classing of fleeces had become well established in Australia and New Zealand.

for this purpose mainly the well-prepared foreign wools. Australian wools, because of their superior whiteness and other qualities, apparently can be used most effectively in the manufacture of such fabrics. Although the Labeling Act may promote the sale of virgin wool, the benefits have gone mainly to foreign rather than to domestic wool. For best results, the use of labeling to strengthen the competitive position of domestic wool apparently would need to be supplemented by adequate preparation of this wool to meet manufacturers' requirements.

PRICE SUPPORTS AND OTHER PROGRAMS

Public concern regarding wool has increased since 1942 as a result of the great decline in domestic production (table 6), coupled with the possibility that the supplies of foreign wool might be cut off in time of war or other emergency. The inadequacy of tariffs and of the Labeling Act to maintain domestic production of wool at levels required to meet the nation's emergency needs is generally recognized (*4, 18*). A change in public policy regarding wool is indicated by the redirection of Government wool programs during and since World War II. None of these programs, however, were concerned directly with the problem of growers' preparation of wool, although some of them increased the need for such preparation and others may inadvertently promote it.

TABLE 6.—*Apparel wool: Production and consumption, scoured basis, United States, 1930–52*

Year	Production shorn and pulled wool [1]	Consumption of apparel wool [2]	Year	Production shorn and pulled wool [1]	Consumption of apparel wool [2]
	Million pounds	*Million pounds*		*Million pounds*	*Million pounds*
1930	201. 4	200. 7	1942	220. 9	560. 5
1931	215. 1	237. 7	1943	215. 6	603. 3
1932	204. 8	188. 5	1944	204. 0	577. 0
1933	212. 8	245. 5	1945	188. 4	589. 2
1934	207. 7	167. 6	1946	169. 6	609. 6
1935	208. 6	319. 0	1947	153. 1	525. 9
1936	205. 1	299. 8	1948	136. 9	485. 2
1937	206. 3	274. 2	1949	120. 4	339. 0
1938	206. 7	219. 6	1950	119. 1	436. 9
1939	207. 5	293. 1	1951	118. 7	382. 1
1940	210. 2	310. 0	1952	127. 4	346. 9
1941	219. 9	514. 4			

[1] Reported production converted to scoured equivalent at estimated yield of 44 percent for shorn and 75 percent for pulled wool.
[2] As reported by Bureau of the Census.

Experiences during World War I, when part of the 1917 and all of the 1918 domestic clips were bought by the Federal Government, served as a precedent for Government marketing activities during World War II (*23, 21, 14, 40*). In 1940, when the Federal Government began to place large military orders, the War Department, under the pro-

visions of the Buy America Act of 1933, required that domestic wools be utilized so long as they were available in the grades needed. Beginning in 1941, the War Department paid a premium on fabrics made from domestic wool. Ceiling prices, put into effect in February 1942 by the Office of Price Administration, were based on late 1941 market prices, which favored domestic wools. Under these provisions, prices of domestic wools at Boston during most of the war period were maintained substantially higher, grade for grade, than the duty-paid prices of imported wools (*54*). With imported wool available at relatively low prices, sales of domestic wool were largely for military orders and relatively small quantities were bought for civilian use.

In April 1943, the Commodity Credit Corporation was, with minor exceptions, made the sole purchasing authority for domestic wools. War purchasing programs of the Corporation were handled through the wool trade. Private dealers, warehousemen, commission agents, and cooperatives with facilities for buying, grading, sorting, and selling wool were designated "handlers," if they complied with the regulations of the Corporation. Under these programs, local dealers continued their assembly functions and sold the wool to regional or central market dealers who graded when necessary, stored, and resold the wool to mills, topmakers, or others. Much of the wool was stored and handled by dealers and warehousemen in the Western States and as a result warehousing activities in that area were stimulated. This brought marketing and preparation services closer to the growers and it may have established a foundation on which more effective preparation of western wool can be based.

Purchase prices of the Commodity Credit Corporation were based mainly on ceiling prices of the Office of Price Administration for domestic wool, scoured basis, delivered in Boston. The value of each lot bought from dealers was determined by an official appraiser of the United States Department of Agriculture. Growers received the appraisal prices, less handling fees, costs of transportation, costs of grading and scouring, and others when applicable. A fee of 1⅛ cents a pound to cover costs of appraisal, storage, and interest was also deducted by the Corporation. From 1944 through 1946, all of the domestic clip was handled by the Corporation on this basis.

With the cessation of hostilities in 1945, the demand for wool for military purposes shrank rapidly. Sales by the Commodity Credit Corporation also shrank until November 1945, when it was permitted to reduce selling prices in order to reduce its stocks. Later the Corporation was forced to raise prices to conform to the prohibition against selling below parity. The disposal of accumulated stocks was again restricted until August 1947 when Public Law 360 gave the Corporation authority to lower prices below parity. This law also authorized the Corporation to support wool prices to growers at previous support levels until 1949 and provided for a pricing pattern more in line with the then current prices. Increased marketing fees for dealers and handlers were also authorized.

Prices for fine wools had increased sharply abroad and the Commodity Credit Corporation's selling prices for these wools had been relatively low. The result was that fine and half-blood wools made up about 90 percent of total sales from April to September 1947. Under these conditions, the Corporation was able to sell as much wool as

it bought, but by the end of 1948 accumulated stocks totaled 334 million pounds, compared with 371 million pounds in September 1947. During 1949, however, stocks were disposed of more rapidly and by the spring of 1950, they had virtually disappeared.

The Agricultural Act of 1948 extended the Corporation's purchasing program on its previous basis through 1949. The 1949 Act provided for continuation of the support program, established a new basis for computing the parity price for wool which raised it by 5 or 6 percent, and provided for support of the prices of wool at such levels between 60 and 90 percent of parity as might be necessary to encourage annual production of about 360 million pounds of shorn wool. This policy has prevailed since 1949.

The 360 million pounds of shorn wool specified, plus the usual amount of pulled wool, are less than domestic consumption for any year since 1934. In time of war or preparation for war, this would be far short of requirements. If sea lanes were to be closed for war, this supply of wool would be inadequate for civilian and military needs. These were the conditions back of the decision of the Department of Defense to alter its traditional policy on use of wool in its military fabrics. Early in 1951, that Department announced a policy designed to reduce the requirements of the military services for new wool by: (1) Permitting the use of lower grades of wool, (2) adopting lighter weight fabrics for certain military purposes, (3) increasing the quantity of reprocessed and reused wool permitted in fabrics, and (4) using synthetics and other fibers when suitable (*40*). Defense mobilization agencies authorized the expansion of the production capacity of synthetic fibers in 1951 and 1952.

Developments in recent years emphasize the fact that neither manufacturers nor consumers are so closely attached to domestic wool that they will not shift to substitutes in response to favorable prices and quality. Public policy relating to wool has emphasized price supports and protective measures for domestic wool. Increased competition, particularly from manmade fibers, emphasizes the importance of improvements in quality, production efficiency, preparation, and marketing also.

Standardization and Grading

The feasibility of preparing wool at or near points of origin may be greatly influenced by the availability of adequate standards for the chief quality elements of wool and of classifiers trained in the use of such standards. Official United States standards for grades of wool, based on fineness or diameter of the fibers, were established by the United States Department of Agriculture in the 1920's. Two systems of designating grades are the blood or American system and the count or English system, as follows:

Official U. S. Standards for Grades of Wool (44a)

Blood system	*Count system*
Fine	80s, 70s, 64s
Half-blood	60s, 58s
Three-eighths-blood	56s
Quarter-blood	50s, 48s
Low-quarter-blood	46s
Common	44s
Braid	40s, 36s

The blood system originally was presumed to designate the proportion of merino (fine-wool sheep) blood in the sheep from which the wool was shorn. Today it refers only to the fineness of the wool and has no relation to the breed or breeding of sheep. The count system was based on the number of hanks of yarn (each 560 yards in length) that could be spun from a pound of clean wool. Now the count system also refers only to the fineness of the wool.

Several years ago a set of 12 wool grades were promulgated to serve as a guide for the breakdown of individual fleeces and clips into uniform lots, called "matchings", prior to processing. Recently a set of six grades of "wool market classes" was developed as a basis for broad classing of fleeces as they come from the sheep. These grades are entirely visual and relate to fineness only. Specifications for other important characteristics of wool fibers are not available although they are in process of development (*35*).

In the absence of standards for length, strength, color, foreign-matter content, black-fiber content, and other characteristics which affect the usefulness of wool to manufacturers, growers have inadequate bases for sorting and grading, and for evaluating the importance of preparing wool (*20*). Under these conditions different criteria are used in sorting and classifying wool.

Uniform standards for all the chief elements of quality, based on manufacturers' requirements, are greatly needed by growers and others for use in sorting and classifying wool. Lacking such standards, it is difficult to establish an adequate classification service for growers. Such a service would encourage better preparation before the wool is sold by growers, supply a basis for evaluating the benefits of such preparation, and facilitate handling and marketing.

Many problems may be involved in developing adequate standards and in establishing and operating an adequate classification service to growers. Because of the large number and the characteristics of the elements that enter into the quality of wool, the preparation of adequate standards based on manufacturers' needs would be difficult. But standards for fineness are already established and standards for other important elements might well be set up, perhaps on a tentative basis, as a first approximation to a comprehensive set of standards. Some difficulties may be involved in getting growers and marketers to accept and use such standards in marketing wool. Even some manufacturers who have standards of their own may need encouragement to use classifications based on general uniform standards. But adoption and use of adequate standards and classification services would greatly facilitate the handling and marketing of wool.

Availability of uniform standards and public classification services alone may not be enough to assure the improvements needed. For best results such standards and classification services would need to be adopted and used generally by those who prepare and market wool—growers, marketers, and manufacturers. Extension specialists and others would need to do a great deal of educational work with regard to the benefits to be derived from full use of these standards and classification services (*7*).

Handling and Marketing

Services involved in handling and marketing wool include shearing and handling at the ranch or farm; packaging and assembling in

quantities adequate for efficient marketing, transporting, storing, and merchandising; and varying amounts of preparation and processing. Preparation or processing of wool may take place at any one of a number of stages in the marketing procedure. Information relating to the conditions under which wool is handled, and the methods and practices involved at each stage in the marketing procedure, may be helpful in determining the relative advantages and disadvantages of preparing wool at or near points of origin.

SHEARING AND HANDLING AT RANCH

Two different types of shearing operations are followed in the range area. Large operators usually have their own shearing sheds. These sheds provide corrals for separating the sheared from the unsheared sheep, a spacious and clean shearing floor, and suitable equipment for packing and storing the wool. Smaller producers either set up temporary sheds on their ranches or trail their sheep to commercial shearing sheds. As indicated previously, (p. 10), producers with fewer than 600 sheep account for a large proportion of the total number of producers but for a relatively small proportion of the wool produced. Most of the shearing is done by itinerant crews who charge a fixed price per head of sheep.

The nature and extent of preparation at the time of shearing vary considerably from one ranch to another. In typical ranch operations only such objectionable parts of the fleece as tags (locks matted with sweat and manure) and badly stained wool are removed and packed separately. The fleece is then rolled, flesh side out, into a rectangular shaped bundle and tied with heavy paper twine. These tied fleeces are then packed into bags 7 feet long and 3½ feet wide. Texas bags are only 6 feet long and the fleeces are not tied. These large Territory bags hold from 35 to 40 fleeces and, when filled, average about 300 pounds in weight. An increasing number of sheepmen are crutching their ewes in the early spring prior to lambing. Careful operators segregate yearling, black, and buck fleeces and bag them separately from ewe wool. Other variations include some skirting and a limited amount of grading at the ranch.

Adequate preparation of wool at the ranch, in accordance with the needs of manufacturers, may require a number of operations before and after shearing. If flocks are large and not uniform, it may be desirable before shearing to segregate sheep with black, gray, burry or other defective fleeces from those with clean white wool. If the flock varies widely as to length and fineness of wool, the sheep should be separated into groups with uniform length and fineness of wool. Yearlings, rams, and old ewes might also be grouped separately to give uniform fineness and length.

Sheep would need to be tagged before shearing, that is, the heavy dung locks should be clipped off and packed separately from the fleece. If left on the fleece, such locks stain the wool. They contain enough foreign material to make separate processing desirable. Paint and tar should be clipped before shearing, as the detergents used in cleaning the wool do not eliminate them. If paint and tar-tipped fibers pass through into the yarn, they appear as dark specks in the fabrics, which cannot be eliminated even by dyeing. They also interfere with operation of spinning and weaving machines.

After the sheep are segregated and tagged preparatory to shearing, several things can be done to help maintain the quality and uniformity of the wool. Some of these are: (1) Shearing only when the wool is dry, to prevent molding, discoloration, and other deterioration of the fibers; (2) shearing on a clean floor to prevent dirt and other foreign matter from contaminating the fleece; (3) shearing carefully, cutting closely, and removing the fleece unbroken to maintain maximum length and uniformity of fibers and to keep the fleece intact for sorting; and (4) keeping the wool free from trash by removing the fleece directly from the shearing floor to a clean table for the next step in preparation (*5*).

The next steps in preparing wool at the ranch should immediately follow shearing while the fleece is open and loose. As no two fleeces are alike and the wool within each fleece varies considerably, the making up of uniform lots of wool requires sorting both fleeces and wool within each fleece. Grouping of fleeces into uniform lots is usually referred to as "grading," and removing of belly, britch, neck, leg, and other stained portions of wool from the main part of the fleece is called "skirting." Skirting and grading can be readily carried out in one operation at the shearing shed.

As the fleece comes from the shearing floor it should be spread out on a table suitable for skirting and grading. Any remaining tags and coarse or stained wool should then be removed (figs. 3 and 4). These skirtings vary in shrinkage, fineness, and other characteristics and should be grouped into uniform lots as they are removed. In grading, the fleeces, with inferior parts removed, are sorted into uniform lots. These sorts are based on an examination of the fleece to ascertain the fineness, length, strength, and other significant elements of quality. Fleeces with black fibers and those from ewes, rams, and lambs should be kept separate by grades.

Information relating to the possibilities of and limitations to such preparation of wool at or near the ranch is presented in another section of this bulletin (see p. 57).

MARKETING OPERATIONS

Taking wool from farms and ranches and delivering it to manufacturers involves such marketing services as assembling, transporting, grading, storing, and merchandising, among others. Marketers involved in these operations, classified on the basis of the nature and extent of the preparation services and other functions performed, include brokers, commission agents, dealers, and topmakers.

A broker arranges for the purchase or sale of wool and is paid a fee for his services, but usually he handles neither the physical wool nor the financial settlement for it. He takes no part in the preparation of the wool. Some brokers with purchase orders from Eastern merchants or mills go West to buy specified quantities of selected types of wool to meet special requirements. These brokers usually pay the grower by draft and attend to shipping the wool (*54*).

Commission agents, including cooperatives, receive the wool on consignment, take responsibility for its care and preparation while it is held for sale, collect from the buyer, deduct expenses and commissions, and remit settlement to the owner. The volume of wool consigned to

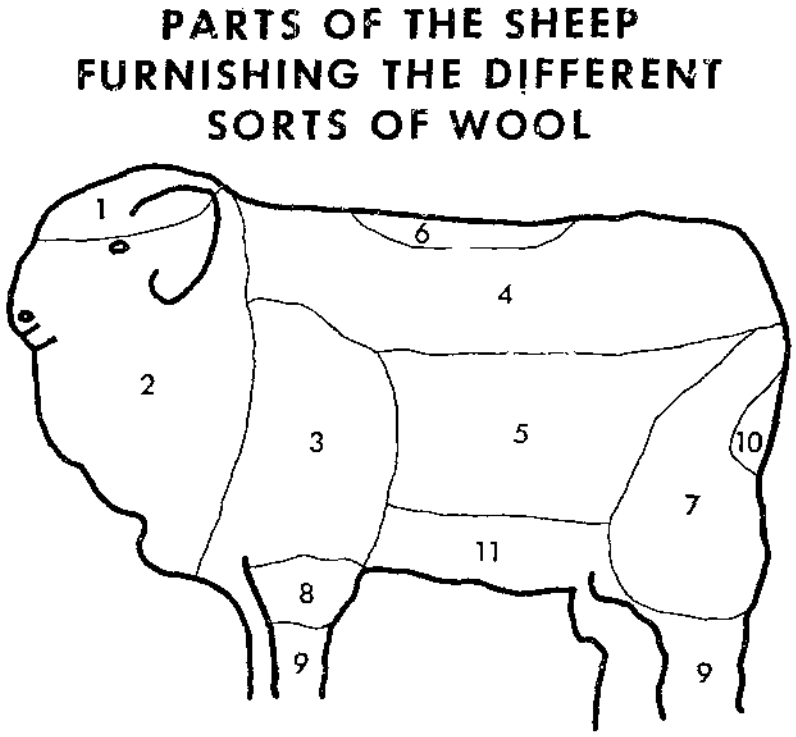

FIGURE 3.—The names of the parts of the sheep and the types of wool prevailing in each part are:

1. *Topknot.*—Very light, short, and inferior wool.
2. *Neck.*—Very light, long-stapled wool; folds contain coarse matted lumps of inferior wool.
3. *Shoulder.*—Usually the best wool in the fleece.
4. *Side.*—Good average fleece wool, usually free from all vegetable matter.
5. *Brisket.*—Similar to shoulder wool; usually heavier shrinking.
6. *Back.*—Wool is inclined to be open and musky.
7. *Britch.*—Coarser wool than other parts of the fleece and inclined to be hairy; wool is usually matted with burs or seeds.
8. *Arm piece.*—Very short wool, heavy with burs or seeds.
9. *Shanks.*—Hairy fibers containing very little wool.
10. *Stained pieces.*—Wool that will not wash white and is very heavy with foreign matter. Wool should be dried before baling.
11. *Belly.*—Good bulky wool, heavy-shrinking, and usually very burry and seedy.

Adapted from American Wool Handbook (*54*).

agents usually is greatest in years when prices at shearing time are relatively low. Such prices induce many growers to store substantial quantities of wool in anticipation of higher prices. Growers who belong to cooperative associations usually consign their entire clip to the association each year during the life of the contract (*11*).

A dealer takes outright possession of the wool, usually pays the full price at the time of purchase, and sells it as advantageously as possible for his own account. Dealers commonly do a great deal of the preparing of wool, especially that of the domestic clip. They can do this because once they have bought the wool they control it. Wool

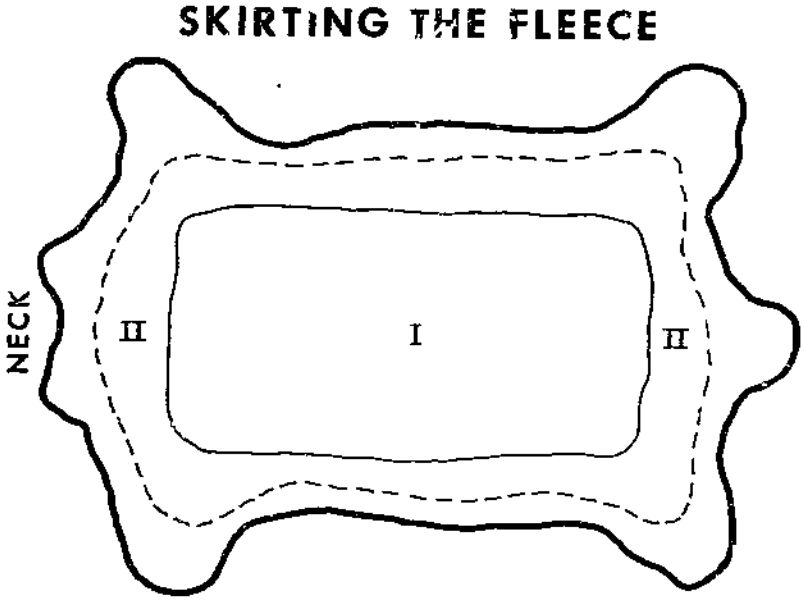

FIGURE 4.—Skirting is the removal of inferior or objectionable sorts, such as tags, shanks, neck, belly and stained parts from the fleece. When the fleece is deeply skirted (I), practically all of this inferior wool is removed. A light skirting (II) may leave a certain amount in the fleece, while an unskirted fleece contains all of it.

Adapted from American Wool Handbook (*54*).

received from different growers may be mingled and sorted. A variation from the ordinary dealer type of operation is the practice of contracting for the purchase of wool before it is shorn. A price is agreed upon and part payment is made before shearing. The remainder is paid on delivery of the wool.

Topmakers usually buy some of their wool outright from dealers in eastern markets. But some buy much wool directly from original sources in the West and Southwest through buyers sent to producing areas. Some topmakers sort this wool but others have it sorted by commission combers who blend the wool according to instruction. Operations of topmakers usually are closely allied with those of the manufacturers to whom they sell the wool.

These four types of marketers are seldom found as distinct entities or firms in the wool market. A given firm may engage in any or all of these operations during any marketing season. But the operations illustrate the kinds of marketers and the preparation and other services available in the market to both grower and manufacturer.

Marketing practices involved in taking wool from a grower and delivering it to a manufacturer vary considerably from one area to another, with differences in size of individual clips, and in other factors. In the territory States, where clips run large, much of the wool is sold at the ranch by the producer to agents for central market dealers, particularly those in Boston. When possible, buyers inspect the clips at the shearing shed or warehouse during the shearing season as a basis for estimating shrinkage and quality, but when such

inspection is not feasible, the wool is examined in the barn, on the ranch, or is bought on the basis of knowledge of previous clips of the same producer. Soon after the purchases are made, the wool usually is shipped to the central market for storage, preparation, processing and manufacturing.

In Texas, a large part of the wool is shipped to warehouses for sale. The warehousemen provide facilities for concentrating wool in volumes large enough for efficient handling, prepare the wool for storage and sale, display sample bags for the inspection of buyers, and grade some of the wool as a basis for sale. Sales usually are made by private treaty, but some warehouses also make use of sealed bids. Many warehouse operators buy some wool from producers who have small clips and a few operators buy large quantities of wool each year (*6*).

In fleece-wool States, where clips usually are small, most of the wool is sold to country dealers who assemble the lots and either sell them to the larger merchants or store them in their own warehouses. Many merchants in the larger cities buy wool from country buyers and resell it to merchants in central markets. In many instances, the wool is ungraded, but in others it is roughly graded into three classes as fine, medium, and rejects. Dealers in central markets send their agents to small towns or to farmer-owned warehouses to buy wool suited to their needs. This wool is shipped to the larger concentration points, where it is graded and otherwise prepared on the basis of mill requirements and sold to manufacturers (*54*).

Substantial quantities of wool are marketed through cooperative marketing associations. But the methods used in physical handling, showing, and selling wool through these associations are similar in most respects to those of other agencies.

Many of the firms which provide preparation and other marketing services for wool operate in or through the central market, particularly Boston. More than 350 wool dealers in Boston are listed in Davidson's Textile Blue Book, and more than three-fourths of them are members of the National Wool Trade Association. These dealers vary greatly in size of organization and in kind and quantity of wool handled. Although 85 percent of the domestic shorn wool is produced west of the Mississippi River, a major part of the preparation and other marketing services are performed by firms located in the vicinity of Boston. That city got its start as a wool market when wool manufacturing was first developed in New England. The fact that the wool-manufacturing industry is still largely concentrated in the Northeast has helped to maintain Boston as the principal market for apparel wool.

Processing and Manufacturing

Wool passes through these marketing channels to processing and manufacturing establishments. At these establishments the wool is sorted, scoured, and carbonized if necessary; that used in woolens is blended, carded, and spun into yarn; that used in worsteds is carded, combed, made into tops, and spun into yarn; the yarns are knitted or woven into fabrics; the fabrics go through finishing processes; and are then ready for fabricators of apparel, household goods, and industrial products.

Most of the combs, spinnning spindles, and looms in place for the wool-manufacturing industry are in New England and the Middle

Atlantic States, although in recent years numbers in the South have increased considerably (table 7). The proportion of the total number of woolen and worsted spinning spindles in place that were located in the South increased from 5 percent in 1939 to 8 percent in 1949. The corresponding proportions for woolen and worsted looms in place increased from 6 percent in 1939 to more than 12 percent in 1949.

TABLE 7.—*Looms, spindles, and combs in place, wool manufacturing industry, by geographic division, United States, 1939 and 1949*

Geographic division	Woolen and worsted looms [1]		Spinning spindles [2]				Worsted combs	
			Woolen		Worsted			
	1939	1949	1939	1949	1939	1949	1939	1949
	Number	*Number*	*Thous.*	*Thous.*	*Thous.*	*Thous.*	*Number*	*Number*
New England	34, 146	21, 695	986	750	1, 564	1, 267	1, 823	671
Middle Atlantic	9, 058	8, 090	464	339	485	414	671	1, 915
South	3, 095	4, 654	154	166	40	96	95	134
North Central	2, 870	2, 532	175	139	41	46		
West	510	522	32	30	11	14		
United States	49, 679	37, 493	1, 811	1, 424	2, 141	1, 837	2, 592	2, 720

[1] Includes pile fabric looms; excludes carpet looms.
[2] Includes woolen spinning spindles in knitting and carpet mills.

Adapted from United States Bureau of the Census, Facts for Industry, wool manufacturing equipment in the United States.

The Boston wool market serves the processing and manufacturing establishments in New England and the Middle Atlantic States. It has been estimated that about 70 percent of the domestic and imported wools consumed in the United States is handled through this market. The importance of the Boston vicinity in marketing and manufacturing accounts for the choice of this region as a locale for the study reported here.

TYPES OF MANUFACTURE

In the manufacture of wool different types of operations are involved, only a few of which are directly influenced by grower preparation of domestic wool (fig. 5). To isolate the significant sectors, a distinction must be made, first, between apparel-wool and carpet-wool industries. Carpet wools are the longer and coarser wools which, because of their resilience and durability, are used chiefly in the manufacture of floor coverings. Wools so used in this country are almost wholly imported, most of them from Asia and South America. Apparel wools are those manufactured into yarns and fabrics suitable for clothing. Wools produced in the United States are almost all apparel wools. The preparation of domestic wool is, therefore, related primarily to the apparel-wool industry.

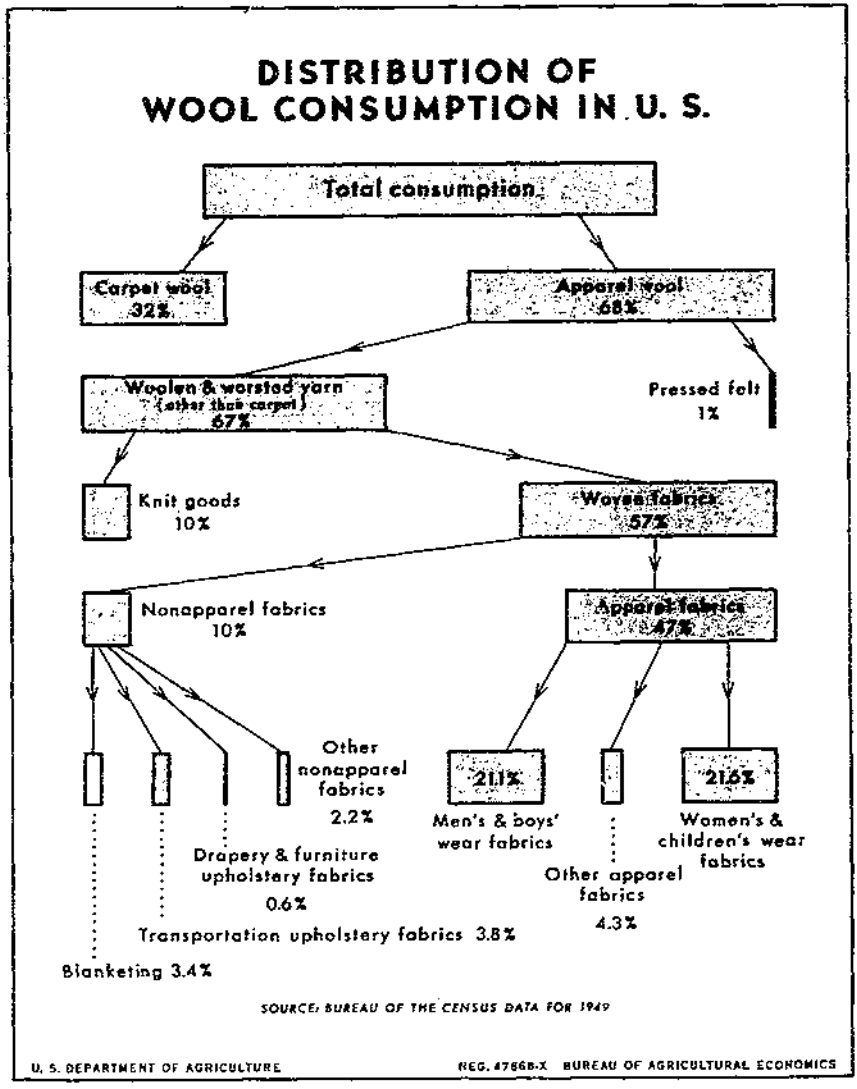

FIGURE 5.—More than two-thirds of the wool consumed in our country is apparel wool and less than one-third is carpet wool. Much of the apparel wool is woven into apparel fabrics, but a good deal is used in both knit goods and nonapparel fabrics.

The manufacture of apparel wool, in turn, may be subdivided according to the principal methods of making fabrics used in apparel. The three methods are weaving, knitting, and felting (fig. 6). For weaving and knitting the fibers must first be spun into yarn. Felts may be made directly from unspun fibers by pressing masses of them together in an environment of heat and moisture. Woven felts are made by combining the two methods. Adequate preparation of the wool is necessary for each method.

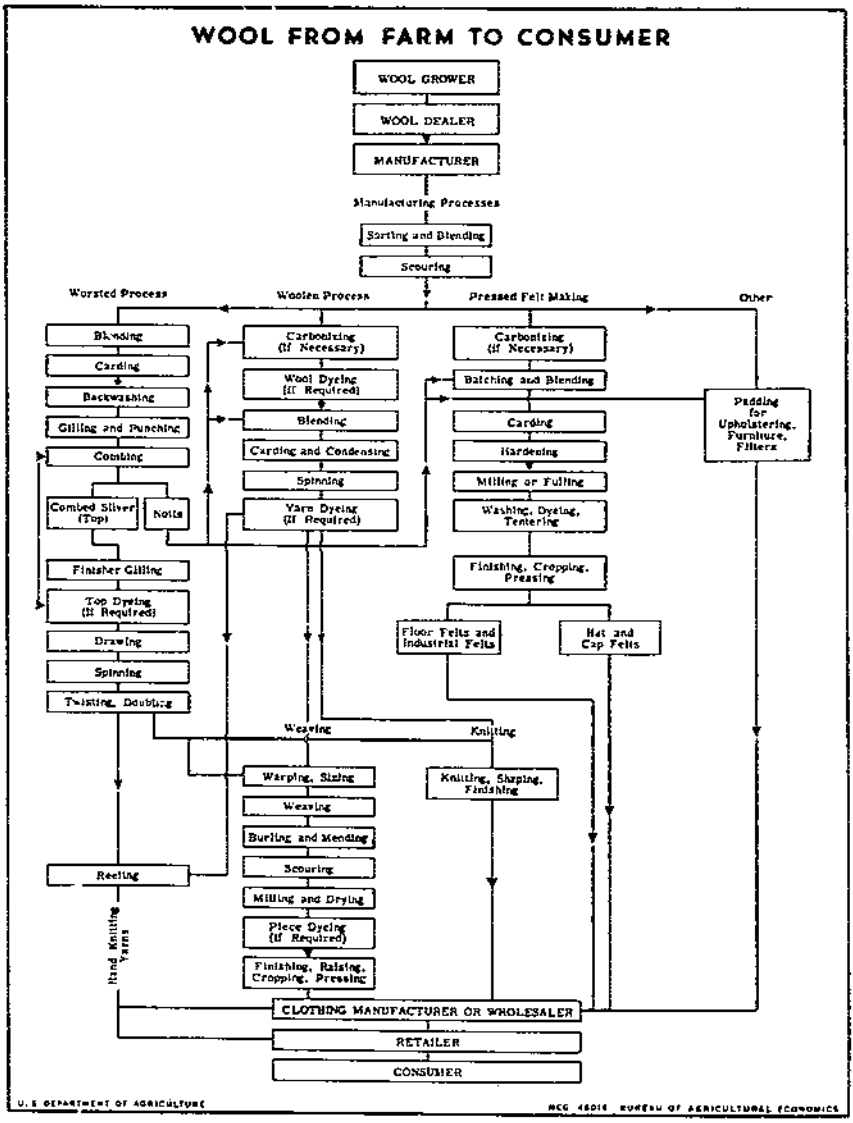

FIGURE 6.—Services involved in taking wool from farms and delivering it to ultimate consumers include merchandising raw wool; processing and manufacturing the wool into finished yarns and fabrics; fabricating these yarns and fabrics into finished apparel, household goods, and other products; and wholesale and retail distribution of the finished products to ultimate consumers. Many channels of movements, processes, and operations are involved in these services.

Most of the apparel wool goes into production of weaving yarns. Only small proportions are used for knitting and felting. In 1950, for example, about 84 percent of the yarn spun on the woolen and worsted systems was weaving yarn and about 16 percent was knitting yarn (*49*).

The apparel-wool industry may also be divided into the woolen and worsted systems on the basis of the processes used in the manufacture of yarn. The distinction is based chiefly on differences in types of wool used and in techniques used in processing wool into yarn. For yarns manufactured on the woolen system, the wool stock requires fewer processes and a lesser degree of parallelization and fiber uniformity than yarn spun on the worsted system. Woolen yarns are spun directly after the wool is carded and both long and short fibers are used. In the worsted system, the carded wool is combed and made into tops before it is spun into yarn. Most of the short fibers are removed by carding, combing, and associated operations.

WOOL REQUIREMENTS

To obtain the precise and consistent quality of yarn and fabric he desires, at the lowest possible cost, a manufacturer of either woolen or worsted fabrics must scrupulously select, prepare, and weigh out the component fibers. A prime requisite in fiber stock is uniformity. The degree of uniformity of the components determines how closely the blend will meet the minimum requirements of the final product, whether top, yarn, or fabric. A manufacturer's cost of raw fiber will be lowest when his blend precisely meets these minimum specifications.

In selecting wool for their particular needs, manufacturers of woolen or worsted fabrics must consider a number of factors. Preparation of wool is one but the first concern is with fineness and length. Strength, color, luster, and vegetable-matter content are also significant. The properties of wool, as it comes from the sheep, vary widely, depending upon the breed and location of the sheep and the part of the fleece from which the wool is derived. Preparation of wool narrows these limits of variation and identifies them. If this has been done before a manufacturer buys the wool, he is able to select more accurately the fibers suited to his particular needs.

Fineness of the wool fibers governs the degree of fineness to which the yarn can be spun, other things being equal, and the fineness of the yarn determines the fineness of the fabric. Diameter of the fiber, however, varies with the breed of sheep, the part of the fleece selected, and, to some extent, with the environment under which the sheep lives. To obtain the uniform degree of fineness necessary to make a precise blend, the fibers must be rigorously assorted within, as well as among, fleeces.

Length of the fiber (or staple) determines whether the wool may be combed and the kind of comb that may be used. Three classes of staples are commonly distinguished in wool trading. They are: "strictly combing" wools, usually interpreted to mean wools more than 2½ inches in length and suitable for combing on the Bradford comb into wool top for the worsted system; "French combing" wools, those with a staple of 1½ to 2½ inches in length, and suitable for combing on the French system for the manufacture of worsteds; and "clothing" wools, those under 1½ inches in length and too short for use on the worsted system but satisfactory for processing on the woolen system. Length of the wool fiber increases as its diameter increases, the length increasing at an average rate of about one-fourth of an inch per grade of fineness (*54*).

Wool for manufacture of worsteds needs to be relatively fine, long enough for combing, and uniform in length and other characteristics.[8] In making his selection for a worsted blend a buyer must consider the fineness of the wool, its length, and other characteristics, as well as the proportion that will have to be removed and resold because it is too coarse, too short, or inferior in other respects. Proper preparation of the wool removes these inferior parts, or sorts, from the wool and enables the buyer to obtain more nearly the kind of wool he requires.

Manufacturers of woolens use a relatively wide assortment of wools. They may use noils, offsorts, reclaimed wool, and parts of fleeces, all in the same blend. Because the fibers in woolen yarns are not paralleled as they are in worsted yarns, a wider range of fiber length can be used. The short fibers become well entangled among the long, and thus, in retaining their position, give body to the yarn. Although a manufacturer of woolens has a wider choice as to lengths, fineness, and other characteristics, he also wants uniformity in the wools he buys. Because he usually combines a greater number of lots of wool, each with widely differing characteristics, he needs to know, precisely, the composition of each lot if he is to get the blend he desires. If each lot of wool has been made uniform by preparation, he can more accurately estimate the quality of the final blend.

Data relating to materials consumed by manufacturers of woolens and worsteds show substantial differences in kind of fibers used. According to census reports, from 1946 to 1950, manufacturers of woolens accounted for about 38 percent, and manufacturers of worsteds for about 62 percent of total consumption of apparel wool in this country. Census reports for 1951, for example, show that about 43 percent of the fibers used by domestic manufacturers of woolens was accounted for by shorn and pulled wool: 24 percent by wool tops, and noils; 19 percent by reprocessed and reused wool; 11 percent by rayon and cotton fibers; and 3 percent by all other fibers. Similar data for manufacturers of worsteds show that 84 percent of the fibers used was in the form of tops from wool of sheep and 16 percent was other tops and prepared fibers. Combining other materials with wool is said to permit fabrics containing wool to be sold at prices low enough so they can be used in low-priced garments that would otherwise be made of cotton or synthetic fibers and to permit style effects that could not be achieved with wool alone (*12, 54*).

PREPARATION AND PROCESSING

When raw wool reaches the mill it must be sorted, blended, and scoured before it is ready for carding on the woolen or worsted systems. Wools lacking uniformity are sorted on the basis of quality—fineness, length, soundness, color, and amount of vegetable matter included. All fibers with similar characteristics are placed in one group. Manufacturers' requirements are used as a guide in sorting and the higher the quality of the goods to be produced, the more carefully the sorting

[8] Some fine wools are too short for combing on the worsted system. Texas wools that are shorn at 6- or 8-month intervals are usually too short for Bradford, and often too short for French combing.

is done. Even well-prepared wool must be looked over for uniformity in quality.

Blending is the process of mixing these various sorts of raw wool or other fibers together to give the best possible stock for the price. Blending may be done either before or after scouring. The technique of blending is usually less rigorous in worsted than in woolen manufacture. Fewer kinds of stock are mixed in the usual worsted, than in the woolen, blend. Satisfactory blending of wool for worsteds usually depends upon accurate selection of a few relatively uniform lots.

Stock used in blends for the woolen system is typically varied. Mixing the various grades of raw wool, wastes, shoddy, cotton, and other fibers to obtain the best possible yarn demands care and skill. This feature is reflected in the key position of the boss-carder in a woolen mill. The success of a woolen manufacturer depends so greatly upon the skillful composition of his yarns that as a rule they are made under his own eye and not bought from others (*8, Vol. II, p. 218; 9, p. 148*). Because of this, specialization is limited in woolen as compared to worsted manufacture.

Scouring is the process of cleaning the raw wool. As sheared from the sheep, wool contains grease, suint or dried sweat, dust, and vegetable and other foreign matter which must be removed so far as possible before the stock is combed or spun. In addition to cleansing, scouring mixes the fibers. Thus, manufacturers of worsteds usually blend the raw wool before scouring so the components may be thoroughly mixed before carding.

The scouring process marks a significant point in the preparation of wool. The fibers become so intermixed in scouring that unsuitable fibers and impurities cannot be removed economically afterward. With few exceptions the defects of preparation must be remedied before the wool reaches the scouring bowls if they are to be remedied at all.

MANUFACTURING OPERATIONS [5]

Although the preparation of wool is usually completed before manufacturing is begun, a brief description of the processes and functions involved in manufacturing operations may be helpful in understanding the importance of adequate preparation. These operations, beginning with carding, are as follows:

Woolen Carding.—When the wool and other fibers have been sorted, blended, scoured, and otherwise properly prepared, they are ready for the carding processes. The main functions of carding are further to open stocks as a whole, disentangle locks and bunches, straighten individual fibers, further to mix the stocks and component parts, and to deliver the stocks in the form of lap or roving for transfer to spinning machines.

Spinning Woolen Yarn.—Rovings from the carding processes are used in spinning. Woolen spinning involves: (1) Drafting, or final drawing out, which is designed to reduce the roving to the weight or thickness required in the yarn; (2) twisting, or insertion of twist

[5] Based mainly on American Wool Handbook (*54*).

in the drafted roving, which gives the yarn sufficient strength for use in either knitting or weaving; and (3) winding on, or packing, in which the spun yarn is put into forms suitable for weaving or knitting operations.

WORSTED CARDING.—Wool for use in worsteds is graded, sorted, scoured, dried, and otherwise prepared for carding processes. Worsted carding is designed mainly: (1) To straighten, separate and, in general, to make long wool fibers lie parallel; (2) to clean the fibers by removing burs, and other extraneous vegetable matter; (3) to blend, distribute, and mix the different lengths and qualities of fibers harmoniously into one uniform quality; and (4) to arrange the fibers into a continuous and convenient sliver of definite weight and thickness. The delivery mechanism at the end of the carding processes is designed to put the sliver from the doffer of the worsted card into a convenient form for efficient handling in the combing processes.

WORSTED COMBING.—Card slivers may be backwashed, oiled, and otherwise prepared for combing. The functions of worsted combing are: (1) To remove short wool fibers below a predetermined length; (2) to straighten and make the retained long fibers lie as parallel as possible; and (3) to remove foreign impurities. The long fibers are retained, made into comb slivers, and later made into worsted top. The short fibers are separated out as a fibrous mass known as noils and used as raw material in the manufacture of woolen yarns and fabrics.

TOP FINISHING.—Slivers from combs are uneven and lack uniformity. The operations known as top gilling or top finishing are necessary to produce from these slivers a commercial top of standard weight, length, and condition. The functions of these operations are: (1) To thoroughly blend fibers of all lengths, (2) to continue the straightening and paralleling of fibers, (3) to condition the wool for the purpose of restoring the natural amount of moisture, (4) to give the sliver a uniform weight, yard after yard; and (5) to wind it into balls of convenient size for handling or sale.

WORSTED DRAWING.—These operations are designed to convert top slivers into rovings small enough to be spun conveniently into fine even yarns on spinning machines. Parallelization of wool fibers is continued and drafting operations are used to the extent necessary to reduce the slivers gradually so that they can be readily spun into single worsted yarns. Doubling is extensively used to reduce irregularities in thickness or weight of the sliver which otherwise would result in uneven yarn.

WORSTED SPINNING.—Operations involved in worsted spinning include final drawing out or drafting, twisting, and winding on or packaging. Spinning produces, from rovings prepared from drawing operations, uniform yarns of the desired thickness, requisite strength, surface, handling qualities, and appearance, put up in convenient form for manipulation, inspection, and use for knitting and weaving.

WEAVING WOOLENS AND WORSTEDS.—Yarns for weaving may need such preparatory processes as rewinding, beam warping, warp slashing and sizing, reeding the warp, twisting in, and drawing before they are ready for weaving. The function of weaving is the formation of cloth or fabrics by interlacing, at right angles to each other, two sets of yarns, one running lengthwise in the loom and termed the "warp," the other running crosswise in the loom and termed the "filling" or

"weft." To establish and correct any imperfection in fabrics, they are subject to numbering, perching, picking, burling, and mending before they are dyed and otherwise finished.

Specialization and Preparation by Growers

The degree of specialization in the wool industry may influence the agencies primarily concerned with grower preparation of wool. If manufacturers were so integrated that firms buying raw wool from growers carried processing and manufacturing through to the finished fabrics, preparation by growers could be directed toward meeting the requirements of those who manufacture different types of fabrics. But growers cannot fit their wool to the needs of individual manufacturers because individual manufacturers seldom buy direct from growers. This accounts for the specialization in the wool industry. Aside from growers themselves, only intermediate handlers and processors of wool are primarily concerned with grower preparation.

Specialization means that manufacturers concentrate on only one, or a few, of the processes involved in converting wool into fabrics. Such specialization is more common in worsted than in woolen manufacture. A manufacturer of woolens usually spins the yarns he weaves because he must know the exact composition of the yarns. But many manufacturers of worsteds either prepare tops, or spin, or weave; and only a few integrate the three operations. Thus many weavers of worsteds buy all the yarn they weave and many spinners buy only wool tops.

Specialization can be carried further in the worsted system because of the greater opportunity to standardize the wool stock used. Because it is machine-made, wool top is more uniform and closer to specifications than the mixed stock used by manufacturers of woolens. Because wool top can be made to fit specifications, and the top required for particular yarns can be purchased, the spinning may be separated from the topmaking operation. Similarly, effective standardization of worsted yarns has enabled the weaving of worsteds to be separated from spinning.

Such specialization limits the firms for which grower preparation is an important consideration. If a firm does only weaving, it is not concerned with whether the wool has been adequately prepared by the grower. Quality and suitability of the yarn are the main concern of the firm's buyer. If the firm does only spinning, its buyer considers mainly the quality of the scoured and combed wool. As firms that do no more than spin or weave, or both, buy no raw wool, they are not faced with the question of whether grower preparation is suitable. They depend upon firms in the earlier stages of marketing and processing to check the suitability of grower preparation and to remedy any defect there is. Under these conditions, firms that buy wool at any point after the scouring process are concerned very little with the suitability of grower preparation. Decisions as to the suitability of grower preparation rest mainly with firms that control wool up to and through the scouring process.

Topmakers are specialized firms. They are concerned with grower preparation because they control the wool from the raw to the scoured state. They buy and prepare wool, then scour and comb it before selling it as top. Topmakers, therefore, are directly concerned with

the suitability of grower preparation because they use wool as it comes from the grower. The importance of their role in wool preparation is indicated by the quantity of wool that they make into top for sale to spinners. In 1947, for example, 149 million pounds of top were produced for sale. This was more than 50 percent of the total top produced in this country and it involved 32 percent of the total wool consumed on both woolen and worsted systems (*42*).[10]

Specialized topmakers can often supply tops of the desired quality at lower cost than they can be prepared by worsted spinners. Their advantage lies in their skill in selecting, buying, and blending wools and in operating their combing equipment at a higher rate than spinners do with their own combs. In addition to providing this special skill in making top, topmakers have also assumed from manufacturers a large part of the risk of loss through changes in price. In taking over the topmaking function they have assumed the cost (and risk) of financing the raw wool purchased, along with sorting, scouring, and combing operations—altogether a significant part of manufacturing costs. In addition to this, they may hold the top in storage until it is needed by spinners and they usually extend credit for as long as 150 days after the delivery to spinners. Mills may have most of the top spun, woven, finished, and sold before settlement must be made with the topmaker.[11] The latter has thus specialized in all three functions—topmaking, financing, and risk-bearing.

These services are provided by topmakers to the worsted spinners who use top. Topmakers also provide services to woolen spinners. In their operations, topmakers accumulate a large part of the raw materials used in the manufacture of woolens. These include the stained pieces and other offsorts, the noils combed out of the scoured wool, and combing and other wastes that cannot be used in the manufacture of worsteds. Topmaker services of financing and risk-bearing are extended on these materials to manufacturers of woolens also.

Because of the large quantity of raw wool they process, topmakers have much to do with the acceptability of grower preparation. When a topmaker buys wool he must decide whether its preparation is adequate; if it is not adequate he must remedy the defects before it is scoured. To the grower, he has become a major arbiter of the suitability of preparation and to the spinner, he assures that preparation is satisfactory.

Many dealers who are not topmakers supply services similar to those of topmakers and play a similar role in the field of grower preparation. They buy the wool outright, remedy faulty preparation, provide a stock of grease and scoured wools for selection by manufacturers, extend credit, and assume the risk of price changes.[12] Dealers

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[10] Noilage of 12 percent included.

[11] "The topmaker . . . has no need for a large establishment . . . His greatest need, in addition to skill in buying, grading, and blending wool, is for capital, which may be his own or, more commonly, may be borrowed from commercial bankers. With this at his disposal, he can perform his task of financing by paying cash for his wool or buying it on short credit terms, paying the comber's tariff promptly, and selling to spinners on relatively long terms." (*11, p. 102*)

[12] Futures markets may provide a means of shifting some of the risk from changes in prices of wool and wool tops.

also provide stocks of reclaimed wools and other fiber materials for manufacturers of woolens.

PREPARATION AND COMPETITIVE POSITION OF DOMESTIC WOOL

As previously mentioned, wool produced in this country is meeting greatly increased competition from foreign-grown wools and from manmade fibers. Further increases may reasonably be anticipated. Appraisals of feasible means for strengthening the competitive position of our wool need to take into account differences between domestic and foreign-grown wools, influences of technological developments, and the competition of manmade fibers.

Domestic Versus Imported Wools

Manufacturers in the United States may substitute imported for domestic wools in response to differences in quality and preparation and differences in price. Such substitutions may be reflected in substantial changes in the ratio of imported to domestic wool consumed.

CONSUMPTION

Data relating to consumption of apparel wool in the United States show that domestic wool accounted, on the average, for about 83 percent of the total during the 1930's, about 33 percent during World War II, 39 percent from 1946 to 1950, and 28 percent in 1952 (table 8). The marked expansion in domestic consumption of imported wools during the early forties was associated with great expansions in imports of wool and in domestic consumption of wool for military and export purposes (table 9). Furthermore, during this period, Boston prices of domestic wool advanced much more than prices of imported wools. Consumption by civilians decreased and domestic stocks of apparel wool increased during the early forties, and in 1946 stocks of both domestic and foreign wools were much greater than in 1940 (*41*).

TABLE 8.—*Apparel wool: Domestic and foreign mill consumption, United States, 1930–52*

Year	Consumption [1]				
	Total	Domestic [2]	Foreign	Percentage of total	
				Domestic	Foreign
	Million pounds	*Million pounds*	*Million pounds*	*Percent*	*Percent*
1930	200. 7	149. 9	50. 8	74. 7	25. 3
1931	237. 7	203. 9	33. 8	85. 8	14. 2
1932	188. 5	175. 4	13. 1	93. 1	6. 9
1933	245. 5	224. 6	20. 9	91. 5	8. 5
1934	167. 6	145. 0	22. 6	86. 5	13. 5
1935	319. 0	293. 5	25. 5	92. 0	8. 0
1936	299. 8	229. 1	70. 7	76. 4	23. 6
1937	274. 2	174. 8	99. 4	63. 7	36. 3
1938	219. 6	194. 2	25. 4	88. 4	11. 6
1939	293. 1	242. 0	51. 1	82. 6	17. 4
1940	310. 0	215. 1	94. 9	69. 4	30. 6
1941	515. 7	223. 1	292. 6	43. 3	56. 7
1942	571. 4	244. 5	326. 9	42. 8	57. 2
1943	591. 9	203. 6	388. 3	34. 4	65. 6
1944	577. 0	150. 9	426. 1	26. 2	73. 8
1945	589. 2	120. 4	468. 8	20. 4	79. 6
1946	609. 6	106. 9	502. 7	17. 5	82. 5
1947	525. 9	161. 2	364. 7	30. 7	69. 3
1948	485. 2	239. 0	246. 2	49. 3	50. 7
1949	339. 0	184. 1	154. 9	54. 3	45. 7
1950	436. 9	186. 8	250. 1	42. 8	57. 2
1951	382. 1	110. 1	272. 0	28. 8	71. 2
1952	346. 9	98. 4	248. 5	28. 4	71. 6

[1] Scoured basis.

[2] Consumption of domestic wool from 1948 to 1952 equals total domestic consumption of apparel wool less imports of duty-paid apparel wool.

Adapted from WOOL STATISTICS (*41*).

TABLE 9.—*Mill consumption of apparel wool and domestic production of wool, grease basis, average 1935–39, annual 1939–46*

Year	Consumption			Domestic production [2]
	Military and export [1]	Civilian [1]	Total [1]	
	Million pounds	*Million pounds*	*Million pounds*	*Million pounds*
Average 1935–39	6	586	592	424
1939	20	610	630	426
1940	96	545	641	434
1941	310	667	977	453
1942	850	227	1,077	455
1943	724	337	1,061	444
1944	483	526	1,009	412
1945	575	438	1,013	378
1946	6	1,045	1,051	342

[1] DOMESTIC WOOL REQUIREMENTS AND SOURCES OF SUPPLY (*48*).
[2] WOOL STATISTICS (*41*, p. 5).

QUALITY AND PREPARATION

Wool produced in the Western States [13] and in Texas compare favorably in fineness and length of staple with other wools consumed in the United States. In 1946, for example, more than 84 percent of the wool produced in the 11 Western States and Texas was of the Fine and Half-blood classes, compared with 68 percent for all wool produced in this country and with 55 percent for apparel wool consumed in this country (table 10). The proportion of Fine and Half-blood wool produced in the 11 Western States and Texas in 1946 was considerably greater than the average for all shorn and pulled wool produced in the country as a whole from 1936 to 1940.

Records for length of staple are not so favorable to western wool. Data showing the distribution by staple length of wool consumed in this country are not available, but apparently relatively large proportions are of the shorter staples. Data relating to the 1946 domestic clip show that more than 90 percent of the wool from the Western States and Texas was in the combing class (table 10). The proportions of the wool from these areas that were Strictly Staple were less, and those of other lengths were greater, than for this country as a whole (table 11). A goodly part of these differences in staple length are accounted for by the practice, common in Texas, of shearing twice a year. The prevalence of this practice is reflected in the large proportion of Texas wool that was graded as French combing in 1946 (table 11).

[13] Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington, and Wyoming.

TABLE 10.—*Percentage distribution of mill consumption of apparel wool and production of shorn and pulled wool, by grades, United States, specified periods*

Grade	1946			Average 1936–40 production of shorn and pulled wool (grease basis)[3]
	Mill consumption of apparel wool (scoured basis)[1]	Production of shorn wool (grease basis)[2]		
		United States	Western States and Texas	
	Percent	*Percent*	*Percent*	*Percent*
Fine 64, 70, 80's	37. 3	54. 5	71. 6	49
½ Blood 60, 62's	17. 6	13. 4	13. 0	15
⅜ Blood 56, 58's	21. 0	15. 4	7. 9	21
¼ Blood 50, 52's	10. 2	10. 3	3. 2	13
Low ¼ Blood 46, 48's	2. 7	. 9	. 7	----------
Common and Braid 44's and coarser	11. 2	. 2	. 3	----------
Low [4]	----------	----------	----------	2
Off wools [5]	----------	5. 3	3. 3	----------
Total	100. 0	100. 0	100. 0	100

[1] Compiled from annual reports of the Bureau of the Census.
[2] "The Domestic Wool Clip—Grades, Shrinkages, and Related Data," based on purchases from the 1946 clip by the Commodity Credit Corporation. Prepared by the Livestock Branch, Production and Marketing Administration, U. S. Department of Agriculture, Washington, D. C., June 1951, Table 2, p. 15 (*47*).
[3] Compiled from U. S. Tariff Commission Report, March 10, 1942, *United States Wools, Production by Regions and by Grades, 1936–1940.*
[4] Includes low quarter blood, common, and braid.
[5] Includes such trade classification as "Offs," "Rejects," etc.

TABLE 11.—*Percentage distribution of production of shorn wool, by lengths, United States, Western States and Texas, 1946*

Length	United States	Western States	Texas
	Percent	*Percent*	*Percent*
Strictly staple	28. 9	21. 5	0. 6
Staple and good French	28. 8	33. 8	30. 0
French combing	38. 9	41. 1	64. 1
Woolen	3. 4	3. 6	5. 3
Total	100. 0	100. 0	100. 0

Derived from data in "The Domestic Wool Clip—Grades, Shrinkages, and Related Data," based on purchases from the 1946 clip by the Commodity Credit Corporation. Prepared by the Livestock Branch, Production and Marketing Administration, U. S. Department of Agriculture, Washington, D. C., June 1951 (*47*).

The data relating to wool produced in Western States and in Texas indicate that much of it meets the requirements as to fiber length and

fineness of the Bradford and French systems for use in the manufacture of worsteds. Most of the wool from these areas could be fitted for worsted manufacture by skirting and grading, either on the ranch or elsewhere.

But preparation of wool from the Western States and Texas has been poor in relation to that for most imported wools. As previously indicated (page 23), relatively small quantities are well prepared at or near the ranch. Most of this wool, soon after it is sold by the grower, is shipped to central markets for preparation and processing prior to manufacture. Brief descriptions of the processes of preparation of major imported wools may be helpful in indicating the deficiencies in preparation of domestic wool.

Wool imported from Australia is especially well prepared. Most of it is Fine, or Merino type, wool. Usually it is well-tagged and skirted, narrowly classed, and well packed in compressed bales with metal bands to support the jute bags. Almost all of it is fully prepared at the shearing shed. For most fabrics, these prepared wools from Australia require only a superficial sorting or looking over before they are blended and scoured. They are free of shearing trash, tags, and foreign materials. In 1950, more than 86 million pounds of wool (scoured basis), the major part of our imports, duty paid, came from Australia. This was more than 20 percent of the wool used in this country in that year.

Preparation of wool imported from South America has improved greatly during the last 15 years. In both Argentina and Uruguay, the Australian methods of preparation were largely adopted for the high-quality wool exported. These wools are generally well-skirted and reasonably well-classed. In 1950, about 44 million pounds (scoured basis) of apparel wool were imported from Argentina and 74 million pounds from Uruguay. These wools constituted 10 and 17 percent, respectively, of the wool used here.

Preparation of South African wool follows the Australian pattern fairly closely, although it is not always as thorough. Only about 40 percent can be considered well classed (*54*). Some of the remainder is partly skirted and some is packed without skirting. Imports from the Union of South Africa in 1950 totaled 12 million pounds (scoured basis), or about 3 percent of the wool used in this country.

New Zealand wools have been fifth largest in volume of domestic imports during the last decade, but in 1950 they were the fourth largest, amounting to more than 20 million pounds (scoured basis), or about 5 percent of all wool used here. The system of preparation in New Zealand closely follows that of Australia and is usually quite acceptable to our processors. Fewer sorts are made in New Zealand Wool than in Australian—probably because the average New Zealand flock is smaller than in Australia. Fleeces are skirted and graded. Bellies, leg wool, necks, breech wool, and crutchings are kept separate and are classed by grades. They are imported in this form.

Thus, it appears that most imported wools are relatively well skirted, assorted, and classified. Their dominance in domestic consumption in recent years has tended to cause topmakers and manufacturers to want and expect greater uniformity than is usually found in our own wool. Poorly prepared domestic wools, which do not fit our manufacturing techniques and requirements so well have been less favored than in the prewar period. These developments

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may account for the attitude taken by topmakers and manufacturers toward the preparation of wool from the Western States and Texas.

Differences in uniformity are illustrated by sorting reports for two large lots of typical Texas and Australian wool (*54*). The Texas lot contained 26 percent of wool too short for combing, whereas all the Australian wool was long enough for combing (table 12). Loss in sorting the Texas wool was almost double that for the Australian, indicating excessive quantities of trash in the former Texas wool shows a much larger proportion of undesirable black, paint, and stained wool. Australian wool has a higher concentration within the main sort and within one grade on either side of the main sort—almost 97 percent for Australian compared with 88 percent for Texas wool. Similar differences in preparation of domestic and imported wools were confirmed by a field survey of manufacturers.

TABLE 12.—*American and Australian wools: Percentage distribution, by sort*

Sort	American [1]			Australian warp [4]
	Warp [2]	Filling [3]	Total	
	Percent	*Percent*	*Percent*	*Percent*
Loss			5.00	2.80
80s	1.40	0.87	2.27	.22
70s	17.56	5.52	23.08	21.42
64s	41.02	20.68	61.70	65.02
60s	2.76		2.76	10.15
58s	.13		.13	.07
40s	.03		.03	
64s burry			1.10	.30
Black			.09	
Felted			.03	
Paint			.08	.02
Stained			3.29	.005
Strings			.56	

[1] Original 12 months Texas wool, 40,000 pounds.
[2] Length over 1½ inches.
[3] Length less than 1½ inches.
[4] Includes 30,000 pounds of 64s combing all more than 1½ inches in length.

Adapted from American Wool Handbook (*54*).

Manufacturers' criticisms of the preparation of Territory wools and their preference for Australian prepared wools were stated in their replies to the question on the technical operations required in preparing Territory versus Australian wools for spinning in the mill. Seventeen manufacturers were interviewed and ten reported. The other seven either used top or yarn only or failed to report.[14] Four manufacturers of woolens who bought only scoured wool thought there

[14] The seven included four who bought top only, one commission spinner, one commission weaver, and one who bought grease wool for worsted spinning. Only the latter firm failed to report. The wool bought by the other six was already too far advanced in processing to permit effective criticism of preparation by the growers.

was no difference in the technical operations required once the wool was scoured, because any faults in grower preparation had been corrected by market agencies before scouring. One said, however, that Territory wools had more burs than Australian and thus needed more bur picking.

Six manufacturers of worsteds bought all or part of their wool in the grease and all emphasized the increased cost of preparing Territory wool for spinning relative to Australian. Four stressed that a much heavier sorting was required on Territory wool—that Australian required trap sorting only. The cost of topmaking was therefore much higher for Territory wool because of the increased outlay for labor. Two firms estimated their cost of making top from Territory wool to be 10 to 15 percent higher than when Australian wool was used. A fifth reported that better putup and less tar and paint in Australian wools reduced the operations needed in preparing the wool for spinning.[15] The sixth, who bought grease wool but had it sorted and scoured on commission, reported that Australian wools gave a better "handle" to the fabric and that 64s Australian would spin into finer worsted yarn than 64s Territory.

The same firms were asked to state their opinions of Territory wool as placed on the market by growers. Criticisms, whether or not they applied directly to the preparation of Territory wool were recorded, because of the value of such information to growers. All of the 11 firms using grease or scoured wool—4 woolen and 7 worsted—reported. Their criticisms are grouped below according to whether they are fully (1), partially (2), or only indirectly (3) applicable to grower preparation. The number of firms reporting each criticism is noted at the right.

1. Poor putup and packaging, 3.
Tar and paint not removed and cause difficulties in manufacturing, 3.
Should be graded or sorted better, 2.
Wool from some areas needs tagging, 2.
Growers should be more honest in packaging wool, 1.
Is less uniform than Australian, 1.
Putup is poorer when wool has been contracted prior to shearing, 1.
Growers need to develop a reputation for better preparation and be prepared to stand behind it as do dealers, 1.
Too much waste in Territory wool, 1.

2. Too many black fibers, especially for fabrics in pastel colors, 6.
Too much vegetable matter such as burs, 3.
More is stained than Australian, 1.
Growers lack interest in manufacturers' viewpoint—for example, the need to develop packaging material that does not damage fabrics as do jute sheddings, 1.

3. Is too yellow when scoured relative to Australian wools, 2.
Is not available in sufficient quantity, 1.

These are criticisms of Territory wool as a whole and not of wool from particular parts of the region. Nine of the eleven firms reporting condemned the inadequate care given by growers to tagging, assorting, and packaging the wool (group 1). The criticisms confirm

[15] "The marked difference between the two (domestic and foreign) arises from the difference in condition in which they are bought as grease wool and the resulting difference in costs of converting them from grease wool to wool ready for spinning and weaving. . . . The greater cost of processing domestic wool, because of the necessity of sorting much of it, is perhaps its most important single price disadvantage." (*48*)

other opinions of the poor quality of grower preparation of Territory wools (*54*).

Most of the defects in group 1 could be remedied by better care and supervision in preparing the wool at the shearing shed.[16] These defects arise because: (1) Some growers do not properly select and group their sheep into uniform lots before shearing; (2) some do not remove tags, stained pieces, and other coarse wools at the shearing shed; (3) some do not shear black sheep and black faces separately from white wools; (4) some tie fleeces with sisal string and the sisal fibers damage the fabric made from the wool; (5) some tie fleeces with too many strings, thus adding to the cost of sorting; (6) some use paint or tar for marking sheep, when they could use a soluble marker that would neither impair the fabric nor interfere with the operation of high-speed machines; and (7) some pollute the wool with dirt or water to increase its weight.

It should be emphasized that some of these defects of ranch preparation can never be fully corrected, either by central market agencies or by mills. Once the fleece is rolled and bagged, paint and tar can seldom be completely removed. Variations in length and diameter cannot be as effectively eliminated in later stages as they can be at the ranch. Both of these defects may interfere with the efficient operation of the machines used in the manufacture of textiles.

Although some growers give close attention to the preparation of their wool, the lack of care by some has, in general, given wool from Western States and Texas a reputation among manufacturers for poor preparation. As a result, all Territory and Texas wools are considered to be poorly prepared and prices are affected accordingly. A difficult problem in ranch preparation will be to convince manufacturers and other users of wool that it can be prepared adequately to meet their needs.

More firms were critical of the black fibers found in Territory wool than of any other single feature. An increase in output of fabrics dyed in pastel shades was reported as enhancing the seriousness of this defect. Black fibers, which originate mainly from black and black-faced sheep, become mixed with white wool when the sheep are sheared. They affect adversely the usability and market value of such wools because they cannot be used in white yarns or fabrics or in fabrics that are to be dyed pastel shades (*48*). Manufacturers report that black fibers are found within fleeces that have had no contact with wool from black or black-faced sheep.[17]

PRICES

Differences in quality and preparation of domestic and imported wools usually are reflected in differences in prices in central markets.

[16] Only a small part of them can be attributed to conscious attempts by growers to cheat buyers, although this was reported to be more prevalent when wool was contracted prior to shearing.

[17] The source of black fibers is an important consideration for wool growers. If black fibers in white wools are caused by contact with black wools, the remedy may be readily found in greater care in shearing, assorting, and packaging the wool. If black fibers are found in white wools that have not been exposed to black fleeces, reselection of breeding stock and a breeding program designed to eliminate black fibers from fleeces would be needed.

Prices of Australian wool, duty-paid, in Boston, for example, usually are considerably higher than those for comparable qualities of Territory wool. During the 1930's, Boston prices of Territory wool, Fine combing (staple, 64s and finer), clean basis, averaged about 86 percent of the corresponding prices of Australian wool, 64s–70s, good topmaking, clean basis (table 13). Early in the 1940's, with price supports for domestic wool, prices of this wool advanced in relation to those for imported wools. From 1940 to 1945 prices of Territory wool at Boston averaged 107 percent of the comparable prices of Australian wool. In the postwar period, prices of imported wool advanced more than those for domestic wools. From 1948 to 1952 prices of Territory wool at Boston averaged about 90 percent of the corresponding duty-paid prices of Australian wool of comparable quality.

TABLE 13.—*Territory and Australian wools: Price per pound, specified grades, cleaned basis, Boston, 1930–52*

Year	Territory wool, Fine combing, 64s and finer	Australian wool, 64s–70s, good top-making [1]	Territory as a percentage of Australian
	Cents	*Cents*	*Percent*
1930	76.2	88.7	86
1931	63.1	80.6	78
1932	47.0	64.7	73
1933	67.0	79.9	84
1934	81.6	95.9	85
1935	74.8	86.6	86
1936	92.0	100.2	92
1937	101.9	105.9	96
1938	70.4	84.4	83
1939	82.7	86.4	96
1940	96.3	95.4	101
1941	108.8	103.5	105
1942	119.1	109.4	109
1943	117.8	109.9	107
1944	119.0	106.1	112
1945	117.7	109.2	108
1946	102.6	110.1	93
1947	124.2	136.9	91
1948	164.6	185.4	89
1949	166.4	195.8	85
1950	199.2	224.2	89
1951	270.5	284.6	95
1952	165.3	175.5	94

[1] Prior to January 1938, description reads, "64s, 70s averaged" Duty per pound of clean content added to clean basis in-bond quotations reported by Market News Service, USDA, as follows: January 1924–May 1930, 31 cents; June 1930, 32.5 cents; July 1930–December 1947, 34 cents; January 1948 and thereafter, 25.5 cents. (Prepared by A. M. Hermie, BAE.)

Production and Marketing Administration.

The relatively high price of Australian wool, duty-paid, in relation to comparable prices of Territory wool, before and since World War

II, reflect responses of price to discrimination in favor of well-prepared Australian wool. Growers, who are looking for ways to increase their returns, may possibly be able to strengthen the relative prices of their products by more effective ranch preparation. Although much of the difference between prices of Australian and Territory wool may come from differences in preparation, price benefits to growers obtainable as a result of improvements in ranch preparation may be hard to ascertain. To measure such benefits, comparisons would be needed of representative prices of prepared wool of known qualities with representative prices of unprepared wool of similar qualities, with the influences of other factors held constant.

Prices on such a comparable basis are seldom available. To obtain them would require data relating to prices of wools that are comparable in quality (other than preparation) and also in time and place of marketing and in terms and conditions of sale. In presenting requirements for estimating differentials for tariff purposes, the United States Tariff Commission stated that, "For any given grade, and particularly for short-time periods, both domestic and foreign descriptions would have to be valued by several fully informed, highly-trained wool specialists, working together, under identical light conditions, and with the time element between studies of domestic and foreign wools as short as possible" (*55*, p. 17).

In a comprehensive study of wool prices, made in 1937, the Commission concluded that, from 1924 to 1935, the net effect of all factors, other than the duty, affecting prices of wool resulted in a differential of 5.8 cents per scoured pound in favor of Commonwealth wools relative to all domestic wools. The effect on price of differences in preparation between these two groups of wools was estimated at 8 cents for fine, 6 cents for moderately fine, and 5 cents for the coarser wools. With the widening of the price spread between these wools since World War II, the average differential due to preparation is probably greater now than when the Commission made its estimate. A recent Texas study shows that in 1948 the price spread between graded and ungraded fine wools (leaving the effect of skirting out altogether) averaged 3.3 cents a pound (*13*).

An indication of the price differential between skirted and unskirted wools may also be seen in the premiums added to the value when wools are appraised for delivery on futures contracts of the New York Wool Exchange. The Wool Committee of the Exchange provides the following instructions for its appraisers as a guide in evaluating wools (*55*, p. 18):

> If the inspectors find the wool to be fully skirted and packed loose, they shall add 2 percent to their valuation. If they find that the wool is "skirted in the fleece," that is, with bellies removed and as much of the skirts removed as can be seen by turning the fleece without removing the strings, they shall add 1 percent to the valuation. If they find the wool to be unskirted or in the original state in the fleece, they shall add nothing to their evaluation. If they find the wool to be loaded with heavy skirts or "guts" or improperly tagged they shall reject the lot.

When the price of wool is $1.50 per clean pound, this 2-percent addition to the valuation would raise it 3 cents a pound, part of which is attributed to the skirting itself and part to improvement in quality

resulting from skirting. But this is an arbitrary measure of these values and does not necessarily reflect its full market value.[18]

Although the precise value of preparation on the day-to-day market may not be readily determinable, these estimates indicate that it is large enough to be significant to the domestic grower. If the differentials to growers were from 5 to 8 cents a pound, and if a grower feels that he can adequately prepare wool on the ranch for less than this, there would be open to him the possibility of increasing his returns by preparing the wool himself.

Influence of Technological Developments

The competitive position of poorly prepared wool has been further weakened, in recent years, as a result of technological and other developments in the wool-manufacturing industry. These developments were associated with large increases in costs of labor, particularly in wage rates, and the development of more automatic machinery for use in reducing these costs. Disadvantages of poorly prepared wools have been aggravated, as a result of these developments. Manufacturers tend to increase their discrimination against wool that requires much labor in preparation and to increase their preference for wool uniform enough to meet the requirements of the more automatic machinery and improved methods in use.

LABOR COSTS

Wages accounted for about 43 percent of gross operating margins for manufacturers of woolens and worsteds in 1947, according to Census reports. Average hourly wage rates of workers in the woolen and worsted manufacturing industry in 1952 were almost three times as great as in 1939. These facts emphasize the importance of evaluating the influence of cost of labor on the problem of wool preparation.

The cost of fitting poorly prepared wools at the mill for manufacture appears, to mill operators, to be so high that discrimination against such wools is warranted. Their costs of preparation are high because sorters, who prepare the wool at mills, have been able to impose restrictions on the rate of sorting, which increase the costs of sorting. Preparation of wool is almost wholly a manual operation in mills and costs of manual labor have risen a great deal in recent years.

For many years the trade of wool sorting has been guarded by strict entrance requirements, which include several years of apprenticeship. Wool sorters are highly organized. They were the first group of textile operatives to organize effectively into a strong union

[18] The Exchange allows no compromise with respect to deliverable wools meeting the requirements of "graded" wool:

The inspectors shall first determine whether there is sufficient uniformity in the putup of the lot for it to bear inspection. If it is the opinion of the inspectors that the original fleeces, of which the lot is composed, vary from each other in yield, character, grade, or staple, by an amount greater than is generally accepted by trade custom for graded wools, they shall reject the lot as unfit for delivery (*55*, p. 16).

in the English industry (*8, p. 205 ff.*) and Cole records how their organization in wool manufacture in this country succeeded in imposing a "stint" or maximum limit of work per period of time (*9, Vol. II, p. 125*). Wool sorters have retained this concept of the stint. Cases were reported in the field survey in which labor unions, by restricting the output of sorting, had curtailed production throughout an entire mill.[19]

These restrictions, when added to the increase in wages and other costs of labor, have made the sorting of wool an expensive operation. Manufacturers have tried to reduce these costs by various methods. One method is to trap sort more of the wool. Another method uses belts to speed up the operation. These mass-production methods have reduced the demand for highly skilled craftsmen but the need for sorting has not been eliminated. All wool must be checked as it passes into the blend although the checking may be superficial.

A number of combing plants that had established hourly or daily sorting loads for various types and preparations of raw wool reported that sorters disregarded minimum sorting loads.[20] Serious opposition to bringing in of apprentices was also reported in some cases. One topmaker said he had disposed of his combing plant because of the restrictions on sorting. He had transferred his combing operations to a commission comber.

Mills in which combing is integrated with spinning (and in some cases with weaving) have been especially vulnerable to these restrictions, as sorters may retard operations in all other parts of the plant. Therefore, management has adopted various methods of avoiding sorting limitations. The most effective technique has been to segregate the sorters from other mill operations. This has been done in several ways: (1) For spinners, by buying top from the topmaker; (2) for topmakers, by having their wool combed by a commission comber; (3) for commission combers, by having topmakers employ their own sorters;[21] and (4) for other mills, by using some other designation than "sorters" for such employees. Topmakers have been more fortunate in meeting sorting restrictions. Their sorters are not so fully unionized as those in the integrated mills. Also they do more trap sorting, which enables them to employ less skilled workers who are not so steeped in the tradition of the stint.

But despite these methods for avoiding restrictions by sorters, poorly prepared wools are at a competitive disadvantage relative to well-prepared wools and other fibers. Grower preparation, if adequate, would help manufacturers to reduce their costs of operation.

Restrictions on sorting have become more onerous, in recent years, because the costs of labor have risen rapidly. Average hourly earnings for workers in the woolen and worsted industries rose from about

[19] Interviews with mill operators, topmakers, and members of labor unions disclosed this information.

[20] One interviewee reported the case of a mill where weekly earnings of any sorter which exceeded a limit agreed upon by all the sorters was put in a fund for their common use for recreation.

[21] One commission comber reported that three types or groups of sorters often worked side by side in his plant—nonunion sorters employed by one topmaker, union sorters employed by another topmaker, and sorters employed by the combing firm itself. If a topmaker has difficulty with his own sorters, he can use those of the combing plant. Only about 25 percent of the wool combed in this plant was sorted by the plant's own sorters.

53 cents in 1939 to $1.55 in 1952. This trebling of wage rates has been accompanied by an expansion in the fringe benefits provided for textile labor. These include pensions, sickness and accident benefits, and leave with pay. Increases in wages and other benefits to labor after 1940 were not coincidences. An effective labor union was organized in the wool-manufacturing industry during the late thirties. Increases in wages and other benefits followed. These developments contributed to a growing pressure for manufacturers to shift to new and improved machines.

Other means of reducing labor costs include the shifting of wool-manufacturing plants from New England to the Southern States. As indicated above (table 7, p. 28) such shifts have been in evidence for several years.[22] Differences in costs of labor between New England and the South have been a major factor in the movement, according to views expressed by officials of firms who had moved or were considering moving to the South.

These differences in labor costs are accounted for mainly by differences in wage rates, in fringe benefits, and in workloads. Of the three, workload, or the number of machines operated per worker, apparently influences management most in decisions to move South (*27*, *16*).

In the South, newly employed and largely nonunion workers do not have traditional workloads to cling to as do workers in the older New England industry. Officials expect wage and fringe benefit differentials to be gradually reduced as union organization in the South is expanded. The less effective union organization in the South is probably only temporary. Although only about one in five workers in the textile industry of the South belongs to a labor union, other Southern industries, such as the cigarette branch of the tobacco industry, are almost completely organized (*15*, p. 412).

The increase in costs of labor that started this shift of wool-manufacturing firms from New England has also stimulated buyers of wool to discriminate more against wool that, in terms of labor, is expensive to prepare. Both the high cost of labor and the increased use of new machinery have therefore tended to put poorly prepared wools at a further discount and to demonstrate the advantages of effective preparation by growers.

NEW MACHINERY AND TECHNIQUES

Machinery and equipment used by manufacturers of woolens and worsteds have been improved in recent years and further improvements are needed. Numbers of French combs, worsted spinning spindles of the American system, and automatic looms have increased, whereas numbers of most other kinds of machinery have decreased, in recent years (table 14). Delays in installing new and improved machinery and equipment have been attributed to protection afforded by high tariffs (*9*, II, p. 100). Relatively little new and modern machinery apparently was installed between the two World Wars. A survey made in 1941 showed that most of the machines in place were too old to be efficient in competition with the new and modern machinery available (*24*, p. 22). During World War II, much of the

[22] It is too early to ascertain the extent of this movement. It began before 1940, increased after World War II, and showed little evidence of abating in 1952 (*15*, *29*, *3*, *10*).

machinery in use was overworked and replacement of badly worn and obsolete machinery and equipment with new and improved types was delayed by shortages.

TABLE 14.—*Machines in place, for the woolen and worsted manufacturing industries, by kind of machine, United States, specified years*

Kind of machine	Dec. 31			
	1939	1947	1951	1952
Woolen and worsted looms:	*Number*	*Number*	*Number*	*Number*
Pile and jacquard	(1)	1, 760	1, 730	2, 025
Broad:				
Automatic	26, 816	28, 703	28, 124	27, 505
Nonautomatic	15, 908	6, 509	4, 081	3, 786
Total	42, 724	35, 212	32, 205	31, 291
Narrow	5, 075	1, 600	814	685
Total	47, 799	38, 572	34, 749	34, 001
Carpet and rug looms:				
Broad (8/4 and up)	----------	2, 329	2, 243	2, 224
Narrow (6/4 and under)	----------	3, 354	2, 219	2, 265
Total	----------	5, 683	4, 462	4, 489
Woolen spinning spindles:				
Woolen mills	1, 464, 000	1, 281, 314	990, 715	964, 275
Knitting mills	145, 000	128, 900	88, 426	
Carpet mills	168, 000	150, 984	156, 968	160, 024
Total	1, 777, 000	1, 561, 198	1, 236, 109	1, 124, 299
Worsted spinning spindles:				
Bradford	1, 428, 000	1, 277, 554	1, 100, 106	1, 031, 456
French	655, 000	642, 988	573, 680	509, 168
Other	----------	----------	117, 848	151, 568
Total	2, 083, 000	1, 920, 542	1, 791, 634	1, 692, 192
Worsted combs:				
Bradford	1, 777	1, 681	1, 643	1, 526
French	815	975	1, 164	1, 195
Total	2, 592	2, 656	2, 807	2, 721

[1] Probably included in broad nonautomatic looms.

Adapted from United States Bureau of the Census, Facts for Industry.

Since World War II, however, substantial improvements have been made. Census reports show that expenditures for new plants and equipment by manufacturers of woolens and worsteds totaled $50,009,000 in 1947 and $32,836,000 in 1952, compared with $9,307,000 in

1939. Of the total expenditures in 1952, $27,750,000 were for new machinery and equipment, and $5,086,000 were for new structures and additions to plants.

Growth of the rayon industry, together with developments in cotton-manufacturing machinery, stimulated a minor revolution in the manufacturing industry for textile machinery after World War II. New manufacturing techniques and new designs in spinning and weaving machinery were developed to accommodate the particular needs of the rayon fiber. An outgrowth of these developments in the rayon-machinery industry was the introduction of the "American system" of worsted manufacture by one machinery firm (*25*, pp. 395–396). Originally designed for processing long-staple rayons, these machines were modified and adapted to the technique of the worsted system.[23]

Primarily, the American and the new Saco-Lowell[24] systems of worsted manufacture combine a short-cut method of preparing the top for spinning and an improved spinning frame. The number of stages in the drafting and roving operation (that is, making uniform strands for spinning) are reduced. The machines, including the spinning frames, can be run at higher speed, and yarns can be produced at lower cost, particularly for labor. Saco-Lowell reported that the number of stages between the top and the spinning was reduced from 9 to 12 down to 4. Other companies record similar reductions.

A comparison of systems of worsted spinning shows that the American system has fewer steps and that less labor is required to handle the processed material than the Bradford and French systems (*54*).[25] Similar, though not such spectacular, improvements have been made in the other machinery used in spinning and weaving on both the woolen and worsted systems.

The increased speed and capacity of the new machines as well as their simplicity of operation, have enabled manufacturers to reduce labor costs. The ability to use cotton, rayon, acetate, other manmade fibers, and wool on the new machines, permits production of more types of fabric. A number of representatives of manufacturing firms

[23] This innovation was first introduced by J. H. Walter, President of one of the large worsted manufacturing companies. The American system is sometimes referred to as the cotton system. It is true that certain of its features were taken from the cotton system of spinning (*54*, p. 610). But as it cannot be used to process fibers shorter than 1½ inches, it can hardly be termed the cotton system. Some of the confusion has arisen as a result of the increasing use of wool top on the cotton system in blends with rayon or rayon and cotton.

[24] The Saco-Lowell Bulletin for May 1950, describes their system as follows: "In place of the heavy, cumbersome, and complicated array of equipment now seen in the average worsted yarn-spinning mill, there will be a series of simple machines free from complicated and sensitive subassemblies which are hard for the operative to understand, difficult to adjust, and expensive to maintain." (*33*, p. 19).

[25] Von Bergen and Mauersberger list the advantages *claimed* for the system as: (1) A considerable saving in labor costs, estimated as high as $10 per spindle per year on a two-shift basis for 4,000 spindle mills; (2) the double-apron drafting on both the roving and spinning frames provides better fiber control. There are three disadvantages: (1) The necessity for highly uniform worsted tops because of the small number of doublings; (2) the difficulty of blending colors also because of the small number of doublings; and (3) the lack of flexibility, as only tops of certain rather narrowly defined lengths can be used (*54*, p. 613).

who were interviewed said they thought that within the next 10 years great changes in the manufacture of wool, and particularly of worsteds, would take place as a result of the new developments in machinery and the rapidity with which they are put into use. The principal advantages of the new machines, according to opinions expressed by these manufacturers, are reduced labor requirements, the wider range of staple that can be used, and the ability to shift readily from one type of fiber to another, that is, from wool to rayon or cotton blends.

But to operate efficiently, these high-speed machines require a highly uniform fiber stock. If the stock is not uniform, breaks occur in the roving or yarn at high speeds and the machines stop. Cost of the labor attending the machines then becomes high. Under these circumstances, manufacturers can afford to pay premiums for highly uniform fibers and they tend to discount poorly prepared wools more heavily. Wools that contain paint and tar tips, fibers of varying lengths and diameters, and weak fibers are unsuitable for use on these new machines.

Wool Versus Manmade Fibers

Expansion in production and improvements in quality of manmade fibers may affect the competitive position of wool. Some of these fibers apparently compete directly with wool in apparel, household, and industrial uses. They are delivered to textile mills in good condition for manufacturing operations. No preparation and scouring comparable to these processes for wool is needed. Their uniformity and freedom from defects tend to reduce considerably the costs of making fabrics. New developments in high-speed spinning and weaving machinery place an increasing premium on these advantages. Poorly prepared wools, which lack uniformity and require much manual handling in preparation, are at an increasing disadvantage because of these manmade competitors of wool.

TRENDS IN CONSUMPTION

The relative importance of manmade fibers, from the viewpoint of quantities consumed, is increasing. Total quantities of these fibers used in this country increased from substantially less than the total domestic consumption of apparel wool during the early thirties to more than four times the total domestic consumption of apparel wool during the early fifties (table 15). Consumption of the newer synthetic fibers, which have come into use mainly since 1940 and some of which may compete more directly with wool, amounted to 75 percent of the quantity of apparel wool consumed in 1952 (table 15).

TABLE 15.—*Domestic consumption and price per pound of apparel wool and manmade fibers, United States, 1930–52*

Year	Domestic consumption				Prices per pound	
	Apparel wool [1]	Manmade fibers			Wool [3]	Viscose staple fiber
		Total	Rayon and acetate	Other [2]		
	Million pounds	*Million pounds*	*Million pounds*	*Million pounds*	*Cents*	*Cents*
1930	200. 7	118. 8	118. 8	----------	76. 2	60. 0
1931	237. 7	158. 9	158. 9	----------	63. 1	57. 5
1932	188. 5	155. 3	155. 3	----------	47. 0	45. 8
1933	245. 5	217. 2	217. 2	----------	67. 0	40. 0
1934	167. 6	196. 9	196. 9	----------	81. 6	34. 5
1935	319. 0	259. 1	259. 1	----------	74. 8	34. 0
1936	299. 8	322. 4	322. 4	----------	92. 0	30. 5
1937	274. 2	304. 7	304. 7	----------	101. 9	27. 1
1938	219. 6	329. 4	329. 4	----------	70. 4	25. 0
1939	293. 1	458. 8	458. 8	----------	82. 7	25. 0
1940	310. 0	487. 0	482. 0	5. 0	96. 3	25. 0
1941	515. 7	604. 8	591. 8	13. 0	108. 8	25. 0
1942	571. 4	646. 8	620. 8	26. 0	119. 1	25. 0
1943	591. 9	695. 1	656. 1	39. 0	117. 8	24. 4
1944	577. 0	753. 8	704. 8	49. 0	119. 0	24. 8
1945	589. 2	821. 9	769. 9	52. 0	117. 7	25. 0
1946	609. 6	931. 5	875. 5	56. 0	102. 6	25. 4
1947	525. 9	1, 037. 9	987. 9	50. 0	124. 2	31. 9
1948	485. 2	1, 224. 6	1, 149. 6	75. 0	164. 6	36. 4
1949	339. 0	1, 084. 1	992. 1	92. 0	166. 4	35. 8
1950	436. 9	1, 492. 4	1, 351. 4	141. 0	199. 2	36. 1
1951	382. 1	1, 486. 1	1, 276. 1	205. 0	270. 5	40. 0
1952	346. 9	1, 472. 5	1, 212. 5	260. 0	165. 3	39. 5

[1] Scoured basis.
[2] Includes nylon, Vicara, Orlon, Dynel, Dacron, Acrilan, Fiberglass, and Vitron among others.
[3] Territory wool, fine combing, 64s and finer, cleaned basis, at Boston.

Adapted from Textile Organon (*39*).

Changes in the relative importance of manmade fibers in the manufacture of specified end products may be indicated by data relating to the quantities of these fibers and of wool consumed in the United States in 1937 and 1949. Ratios of the quantities of manmade fibers to wool used in apparel increased from 83 percent in 1937 to 128 percent in 1949. Similar ratios for household goods increased from 18 percent in 1937 to 35 percent in 1949 and those for industrial and miscellaneous products increased from 55 percent in 1937 to 547 percent in 1949. For all groups combined, the ratios increased from 61 percent in 1937 to 137 percent in 1949 (table 16).

More recent data relating to cuttings of men's and boys' apparel show that the ratio of men's regular-weight suits that were made of manmade fibers to those made of 50-percent or more of wool increased

from less than 2 percent in 1950 to more than 9 percent in 1952. Similar ratios for summer-weight suits show an increase from 85 percent in 1949 to 269 percent in 1952, and for separate dress and sport trousers the ratios increased from 50 percent in 1948 to more than 200 percent in 1952 (*38*). It is apparent from these data that manmade fibers have made substantial inroads on market outlets for apparel wool.

TABLE 16.—*Consumption of apparel wool and of manmade fibers, and percentage manmade fibers are of wool used, by specified products, United States, 1937 and 1949*

Product	Apparel wool		Manmade fibers		Manmade fibers as a percentage of wool	
	1937	1949	1937	1949	1937	1949
	Million pounds	*Million pounds*	*Million pounds*	*Million pounds*	*Percent*	*Percent*
Apparel	332. 5	436. 8	274. 5	560. 3	83	128
Household goods	162. 4	219. 7	28. 7	76. 2	18	35
Industrial and miscellaneous	61. 4	63. 4	33. 7	346. 8	55	547
Total or average	556. 3	719. 9	336. 9	983. 3	61	137

Adapted from Rayon Organon (*38*).

These large increases in consumption of manmade fibers in relation to consumption of apparel wool were associated with big advances in prices of wool in relation to prices of these fibers. Prices of Territory wool, fine combing 64s and finer, clean basis, at Boston, advanced from 103 percent of the price of Viscose staple fibers in 1932 to more than 600 percent in the early fifties (table 15, p. 53). Prices of worsted yarn, Bradford 2/32's, advanced from 203 percent of the price of Viscose rayon yarns, 1.50 denier, in 1938 to more than 580 percent in 1951, and from 224 percent of the price of spun rayon yarn, 30/1's, in 1938 to almost 500 percent in 1950 (*39*).

DIFFERENCES IN QUALITY AND LABOR COSTS

Five synthetic fibers—Nylon, Orlon, Dynel, Dacron, and Acrilan—and the regenerated protein fiber, Vicara, apparently will be a serious threat to the competitive position of poorly prepared wool. Rapid expansion in production of these fibers, improvements in their quality or adaptability, and development of new fibers indicate the seriousness of the threat. A brief description of these fibers is given as a basis for indicating the extent to which they are meeting and can meet some of the important attributes of wool that have made it preferred for apparel for many centuries. If they can meet some of the more important quality characteristics of wool, their advantages as to uniformity and lower costs of manufacturing are likely to have a severe impact on the demand for poorly prepared wools.

Nylon is one of the better known of the truly synthetic textile fibers. It is derived from coal, air, water, petroleum, corncobs, cottonseed hulls, and natural gas (*53*). It can be drawn into very fine and uniform fibers for use as continuous filament or as staple fibers. The uniformity in both length and fineness of these fibers is much greater than that for wool (table 17). Nylon has an unusual combination of strength, elasticity, toughness, resistance to abrasion, and other characteristics that make it well adapted for certain apparel, and other uses. The blending of nylon with wool improves the attractiveness of the fabrics, adds to the strength-to-weight ratio which permits sheerness, increases durability, and contributes to other improvements in fabrics for apparel and other uses. Expansion of the use of nylon to products now made of wool is promising, but the extent to which nylon is competitive with, or supplementary to, wool is uncertain. Prices of nylon yarns early in 1953 ranged from $1.65 to $6.00 a pound (*30*).

Vicara, a regenerated vegetable-protein fiber, is derived from corn and is substituted for wool in some blends. It is light and soft but not highly durable. It is found useful by those manufacturers of woolens who carbonize the fabric after weaving, as it can be put through the carbonizing process without apparent damage. It is used in overcoats, suits, sweaters, dresses, socks, scarves, blankets, and some sport shirts. It feels warm and soft, resists shrinkage and moths, has good absorption, and burns like wool. Early in 1953, prices were quoted at $1.00 a pound for unbleached and $1.10 a pound for bleached Vicara staple (*30*).

TABLE 17.—*Fineness, length, and strength of nylon and wool top*

Item	Unit	Nylon top		Wool top	
		3 denier	6 denier	64s	50s
Fineness	Microns	21. 5	30. 2	21. 9	30. 4
Coefficient of variation	Percent	7. 1	8. 7	21. 0	25. 0
Length	Inch	2. 8	3. 6	2. 8	4. 1
Coefficient of variation	Percent	15. 9	14. 2	36. 8	34. 1
Strength per denier	Grams	4. 0	5. 0	1. 3	1. 6
Weight per square inch	Pound	57, 370. 0	72, 040. 0	22, 246. 0	27, 065. 0
Coefficient of variation	Percent	5. 2	2. 8	2. 3	1. 3

Adapted from American Wool Handbook (*54*).

Orlon is close to nylon in tenacity, is stretch resistant, dries rapidly, and is resistant to molds and other microorganisms. It is derived from coal, limestone, petroleum, natural gas, water and air (*53*). Developed during World War II, only the filament was produced in significant quantities before 1952. Orlon offers a combination of warmth, bulk with light weight, resistance to creasing, and durability hitherto unavailable in artificial fibers.[26] These features suggest that Orlon should find a wider use in winter, fall, and spring clothing. Early

[26] Letter to the senior author dated September 21, 1950, from W. R. Heed, an official of the company that developed the fiber.

in 1953, prices of Orlon were quoted at $3.10 a pound for 150 denier filament yarn, and $2.10 a pound for 1.5 denier staple fiber (*30*).

Dynel is a synthetic resin fiber derived from natural gas, salt, air, water, and limestone by a continuous process similar to that for other synthetics (*22*). Fineness, uniformity, and other characteristics of Dynel fibers along with their relatively high resistance to creasing, shrinkage, wear, fire, moths, mildew and fungus, apparently make them suitable for use in suits, dresses, socks, blankets and a number of other products for which wool is now used. Unless blended with natural fibers or nylon, Dynal is very susceptible to heat and static (*53*). Prices in early 1953 were quoted at $1.28 a pound for staple fibers (*30*).

Dacron is one of the newest of the fibers that appear as possible competitors of wool. It is derived from petroleum, natural gas, air, and water (*53*), and was synthesized in 1946 in England and had reached the pilot-plant stage in this country in 1951. Dacron is produced as filament yarn and as staple fibers. The possibilities of Dacron are being extensively explored and commercial production is expected to begin in 1953 (*22*). It is reported that the wrinkle resistance of Dacron fabrics is so good that pleats and creases will remain after months of wear (*32*, p. 3). It is used in suits, dresses, shirts, ties, socks, sweaters, and other apparel. Dacron staple was priced at $1.80 a pound in December 1950.

Acrilan is the trade name of a new acrylic fiber. In 1951 it was planned that Acrilan would soon be produced at an annual rate of 30 million pounds (*26*). It is derived from coal, limestone, petroleum, natural gas, water, and air (*53*). Its characteristics include warmth with light weight, softness to touch, resistance to moths and shrinkage, crease resistance and retention, and resistance to outdoor deterioration. Products made from it include suits, dresses, socks, sport shirts, and blankets, among others (*53*). Early in 1953, prices of $1.85 a pound were quoted for staple fibers (*30*).

In addition to the specific properties noted for each of the six manmade fibers, certain common features of artificial fibers give them significant advantages over wool for manufacture. Because they are machinemade, their quality and uniformity can be controlled to a greater extent. Because they are manmade, their properties and physical characteristics can be modified as the raw components pass through their many chemical processes.[27] Large expenditures for research have brought about greatly improved synthetic fibers and lowered their cost of production. Wool fibers can be modified only to a limited degree.

There are indications that, even in their present stage of development, at least some synthetics can match wool in price and also compare favorably in such properties as drape, warmth, and resilience. In the past these properties have given wool an almost exclusive preference for some uses. In strength, resistance to abrasion, and creasability, some of the true synthetics apparently are superior to wool.

For centuries wool growers have been perhaps justifiably content with the inherent quality of their product. Until recent decades

[27] "Technological progress is increasingly becoming the business of teams of trained specialists who turn out what is required and make it work in predictable ways" (*34*, p. 132).

this satisfaction was hardly subject to question because wool had no close competitors. Certain properties still give particular advantages to wool for wearing apparel. There is, first, the "feel"—a rich warm softness to the touch, a lightness, a resilience—which is difficult to duplicate with other fibers. Its qualities with regard to holding and excluding heat have no counterpart and its strength and durability have only recently been surpassed by artificial fibers. Its structural quality, which prevents a feeling of clamminess in fabrics made from it, is still a major hurdle to be gotten over in the development of comparable synthetics.[28]

Synthetic fibers, however, offer considerable savings in the cost of labor to manufacturers of fabrics because of their greater uniformity and their greater adaptability to standardized machine techniques. They are likely to encourage a greater discount against poorly prepared wools because poorly prepared wools lack this uniformity, are costly to prepare, in terms of labor, and contain defects which make them unsuitable for the new, high-speed machines.

POSSIBILITIES FOR PREPARATION IN PRODUCING AREAS

From the discussion thus far, it may be seen that adequate preparation of Western wool for marketing and manufacture is likely to influence both the competitive position of this wool and incomes to its producers. For best results, improvements in preparation may need to be made at the ranch. But obviously, growers cannot afford the extra costs of improved preparation unless they are at least offset by higher prices received as a result of such improvements.

An appraisal of the feasibility of more thorough preparation of Western wool at or near the ranch needs to be based on information which shows the influences of specified kinds of preparation near points of origin, instead of at eastern manufacturing centers, on the quality and cost of preparation, on costs of marketing and processing, and on the acceptability of the products to handlers and manufacturers.

Factors That Affect Quality and Cost of Preparation

Possibilities for more thorough preparation of wool in producing areas may be influenced by the extent to which such preparation meets requirements of mills and by the costs involved. Specific measures of differences in quality of the preparation of wool at the ranch and at central markets are not available, but opinions of handlers and manufacturers of wool concerning ranch preparation are presented in a subsequent section of this bulletin (p. 74). Data assembled by State agricultural experiment stations show that in recent years costs of

[28] Representatives of wool-promotion groups list, in addition, ". . . ten scientific reasons why you should wear wool." These are: 1. Its elasticity, which is unique; 2. its strength, which is as great as metal; 3. its lightness; 4. its heat-retaining power—wool gives a still air space around the body; 5. its water repellency—it is never clammy; 6. its power to produce heat—because of condensation of moisture by the fiber; 7. its power to transmit ultraviolet light—because the fabric is more open; 8. its natural characteristics as a covering for the body—(it is next to the skin of the sheep too); 9. its luster and softness; 10. its durability (*19*).

preparing wool in Western sheep States averaged 0.6 cent per grease pound for grading and 1 cent for skirting and grading (*37*). Grading charges allowed by the Commodity Credit Corporation in 1946 averaged 0.75 cent per grease pound (*17*) and in 1951 grading charges of 1 cent per grease pound were made by commission agents in Boston (p. 69).

Factors that affect the quality and costs of preparation which may need to be taken into account in ascertaining the feasibility of ranch preparation of wool include size of the clip, facilities and personnel available, and knowledge of mill requirements. These factors are considered in the order listed.

SIZE OF CLIP

Perhaps the most serious limitation to more thorough preparation of wool at the ranch is the large number of small flocks, as discussed previously (p. 10). When a grower shears only a few hundred pounds of wool, the costs per pound of thorough preparation are likely to be relatively high because of inefficiencies in the use of equipment and labor required. Most of the clips from farm flocks throughout the United States would be in this category. Although the average size of flocks in the country as a whole, and even in the Western sheep States, indicates the difficulties of effective ranch preparation at a feasible cost, on many ranches the quantity of wool produced may be large enough for high-quality preparation at competitive costs.

A comparison by size group of flocks in 11 Western sheep States and Texas with those in New Zealand and Australia, where skirting and grading is effectively practiced on the ranch, may illustrate the possibilities in this respect.

Although the proportion of the total number of flocks accounted for by those with 1,000 or more sheep is much less in the 11 Western sheep States and Texas than in New Zealand and Australia (table 18), a substantial number of the flocks in these States have 1,000 or more sheep each. Information available is not adequate for ascertaining the extent to which it would be feasible to bring the smaller flocks together at central locations to facilitate shearing and preparation. In New Zealand [29] preparation of small clips is not usually carried out at shearing sheds. The wool is ordinarily assorted and graded at a local broker's warehouse and there mingled with similarly graded lots for baling and sale. In this country small clips are usually handled similarly, except that the wool is commonly prepared at central markets, often at considerable distances from producing areas.

Large clips account for a major part of the total quantity of wool produced in Western sheep States, New Zealand, and Australia. In 1949, more than 68 percent of the sheep and lambs shorn, and more than two-thirds of the wool produced in the 11 Western sheep States and Texas, were accounted for by flocks of 1,000 or more sheep (table 18). As roughly half of the wool produced in this country comes from these larger flocks in Western States, development of feasible means for improving the preparation of these clips would be a contribution. It is mainly the larger clips that are classed at shearing sheds in New Zealand and Australia.

[29] "About all that is done with smaller clips is to remove the belly wool, the seedy or burry portions, and the crutchings" (*54*, p. 315).

TABLE 18.—*Sheep: Flocks and percentage distribution, by size of flock, 11 Western States and Texas, New Zealand, and Australia, specified periods*

Item	Flock	
	Quantity	Distribution
Eleven Western States and Texas, 1949: [1]		
Size of flock:	*Number*	*Percent*
1–299	40, 292	81. 9
300–999	5, 009	10. 2
1,000–2,499	2, 575	5. 2
2,500 and over	1, 306	2. 7
Total	49, 182	100. 0
New Zealand, 1947: [2]		
Size of flock:		
1–199	7, 197	21. 9
200–999	15, 040	45. 8
1,001–2,500	8, 087	24. 6
2,501–10,000	2, 441	7. 4
10, 001–20, 000	97	. 3
Over 20,000	15	[3]
Total	32, 877	100. 0
Australia, average 1939–45: [4]		
Size of flock:		
1–249	31, 089	31. 0
250–999	41, 920	41. 8
1,000–1,999	13, 532	13. 5
2,000–4,999	9, 300	9. 3
5,000–9,999	2, 978	2. 9
10,000–19,999	1, 074	1. 1
20,000 and over	379	. 4
Total	100, 272	100. 0

[1] Derived from U. S. Census Reports, 1950.
[2] PRIMARY PRODUCTION IN NEW ZEALAND (*28*, p. 27).
[3] Less than 0.05.
[4] Adapted from Statistical Handbook of the Sheep and Wool Industry, Commonwealth of Australia, Bur. Agr. Econ., Dept. Com. & Agr., Canberra, A. C. T., 1949.

Even though improved preparation of wool from flocks as small as 1,000 sheep were not economically feasible, substantial quantities of our wool come from flocks with more than 1,000 sheep. Data for 1949 indicate that about 43 percent of the wool shorn in the 11 Western States and Texas, and more than a fourth of total domestic production was obtained from flocks of 2,500 or more sheep.[30] From these data it would appear that substantial quantities of domestic wool come from ranches on which enough wool is produced for at least fairly effective utilization of the facilities and personnel required for improved preparation.

[30] Weight per fleece in Western sheep States and Texas averages greater than in other States.

Significant benefits to growers may be obtained by improving the preparation of small clips in producing areas. For clips too small for skirting or grading on the ranch, preparation is usually moved farther along the marketing channel to a point at which an adequate volume is available. Warehouses in producing areas are probably the closest points to growers at which the total quantity of small clips would be adequate for effective preparation. There is an advantage to growers in having the operation carried out at a location near enough for them to observe the techniques of preparation. In addition, such warehouses could contribute to the organization of a more effective market in producing areas by bringing a larger number of buyers together at one point.[31] Economies in selling may also be gained by having small clips assorted and commingled into large, uniform lines in the warehouse.[32]

FACILITIES AND PERSONNEL

The availability of facilities and technical personnel may also limit the possibilities of improved preparation of wool in producing areas. Those who prepare wool should have both technical skill and a knowledge of mill requirements as well as suitable equipment, if the quality of preparation is to be acceptable and the costs satisfactory.

Facilities and equipment needed for improved preparation on ranches are not great and the unit cost of providing them would be relatively low, unless the clip is small. In most cases, a shearing floor that can be kept clear of trash, a few rough tables for examining, separating, grading and rolling the fleeces, plus bags or bins to receive the different sorts as they come from the grading table would be adequate. The equipment would need to be designed primarily to keep the wool from contact with foreign substances while the operators are shearing, skirting, grading, and performing other operations. Convenience of arrangement can increase efficiency.

In central markets, facilities and equipment used in grading and sorting wool are relatively inexpensive. A few rough tables for the use of graders and sorters, some large canvas baskets on wheels, bale- or bag-opening tools, sometimes a conveyor belt, space in the building for grading and sorting operations, and storage space is about all that is needed. An investment of a few thousand dollars would supply enough equipment to grade and sort 15 to 20 million pounds of wool a year.

Providing qualified personnel to do the job at the ranch is difficult. Because the shearing of wool is a seasonal activity, it is harder to maintain enough trained personnel for ranch or warehouse preparation in the West than in Boston where the marketing of wool is spread more evenly throughout the year.

More men would need to be trained in the techniques of preparation if ranch preparation were to be done throughout the West. The need for supervision by such men is illustrated by the report on a Texas study of the effect of having a grader at the shearing shed.

[31] The comprehensive development during the last half century of the warehousing system in the Edwards Plateau area of Texas has made a significant contribution in this respect (6).

[32] Growers have the choice of gaining these economies or of maintaining the identity (and control) of their clips.

Results indicate that when a grader was present, more care was taken to keep shearing floors clean, the wool was picked up more carefully, and more attractive fleeces were obtained (*13*). Although this report relates only to Texas, reports from other Western States indicate that throughout the western region the need for supervision by skilled personnel may be equally great.

In addition to more supervision, a larger number of men who also know mill requirements are needed. A commercial warehouse operator in the West who cooperated in a recent study of skirting reported a shortage of qualified men available in the producing areas to do a creditable job of skirting at the corral. If mills or topmakers prefer fleeces skirted, ranch preparation can meet their needs only with the services of fully qualified technicians.

If wool growers themselves are to provide these highly technical services, extension work in this field would probably need to be expanded. These growers might find it more satisfactory to hire qualified men, but more of such men would have to be trained to make available the skilled force needed to improve the preparation of even the larger clips.[23]

Labor is the major item of cost of preparing wool both in producing areas and in central markets. Tagging, skirting, grading, and sorting are not well suited to machine operation. In central markets, conveyor belts are used to lift and move the wool, but no adequate substitute has been found for the manual and visual tests for quality.[24] These tests must be made for each fleece, preferably when it is unrolled. The time required to examine wools of different sorts and qualities cannot be controlled closely enough for effective use of assembly-line techniques, particularly when a narrow range of assorting is desired. Grading and sorting require skilled labor. They usually need men with a number of years of experience. Unskilled or semiskilled labor may be used only for such tasks as opening bags or bales, handing up the wool, and disposing of the sorts.

In 1951 wage rates for graders and sorters varied to some extent in central markets, even among unionized firms, but the variations were not great. Some firms have attempted to avoid restrictions relating to wage rates of sorters by using other titles for these workers but the rates were not greatly influenced by this means. Wage rates of about $1.72 an hour were indicated by most of the firms reporting. Some plants used piecework rates which ranged with the type of wool sorted from about 32 cents per 100 pounds for Australian 64s to 75 cents for domestic 54s. Wage rates for overlookers were somewhat higher and those for helpers were lower than the hourly and piecework rates for sorters.

Firms reported that in 1951 experienced graders who were employed by commission agents and dealer firms in the Boston area received wages of $1.80 per hour. Wages of assistants and helpers ranged from $1.00 to $1.80 per hour. A specialist, called a "wool man" in the

[23] New Zealand, with its much more compact area, has nine men engaged mainly in "advising and instructing (by lectures and demonstrations) farmers in the best methods of preparing their wool" (*28*, p. 73).

[24] The length of the wool fiber is usually estimated by the grader turning small samples over his thumb. The diameter by visual inspection, and the strength by pulling samples of the fibers with his fingers.

trade, who is usually an upper executive, started the grader off in a "line" of grading and checked his work periodically. Such specialists may have buying and selling duties to carry out in addition to general supervision of grading. General supervision of sorting is carried out in combing plants, usually by the plant superintendent or another official.

KNOWLEDGE OF MILL REQUIREMENTS

Trained men, in addition to being able to supervise the preparation of wool, would need to know the kind of preparations that are required by wool manufacturers and topmakers. Familiarity with the different sorts required by woolen and worsted mills, including a knowledge of the most efficient degree of tagging and skirting, the tolerances in grading, and the kinds of fleeces that need special treatment, would be essential in meeting fully the needs of mills. An indication of mill requirements was given in the discussion (p. 31) of the selection of wool stock by mills. They are taken up in greater detail in the following section on manufacturers' preferences.

Effect of Ranch Preparation on Marketing and Processing Costs

If limitations of size of clip, facilities and personnel available, and knowledge of mill requirements can be surmounted, the possibility of increasing growers' returns by improved preparation of wool in producing areas is likely to depend to a considerable extent upon the effect of such preparation on subsequent costs of marketing and processing. If improved preparation in producing areas reduces the costs of marketing and processing wool, returns to growers may be increased by this means, provided costs of this preparation are as low as, or lower than, those for comparable services in central markets and provided further that the full benefits of such preparation are reflected in prices to growers.

Some indications with regard to possibilities in this respect may be obtained from data showing differences between charges made to a manufacturer in Massachusetts, for example, for unprepared (original bag) Territory wool shipped from Denver, Colo., and for skirted and graded wool shipped from Sydney, Australia, through the Boston market (table 19).[35] Additional charges of 1 cent per grease pound for grading and 0.59 cent per grease pound for sorting Territory wool are accounted for mainly by differences in preparation at points of origin. Charges for freight, pier load, and import duty are not directly related to differences in preparation.

[35] It is common practice for our large spinning firms to buy wool at Australian auctions and pay all charges for loading, transportation, customs, and unloading at Boston.

TABLE 19.—*Territory and Australian wool: Charges in marketing and preparing 10,000 pounds of wool for spinning, Lawrence, Massachusetts, 1951*

Item	Charges per 10,000 pounds			
	Territory [1]		Australian [2]	
	Grease	Scoured	Grease	Scoured
	Dollars	*Dollars*	*Dollars*	*Dollars*
Freight to Boston [3]	227. 00	409. 00	404. 50	488. 00
Pier loading charge	----------	----------	3. 00	3. 00
Duty	----------	----------	[4] 1, 275. 00	[4] 1, 275. 00
Truck transportation to storage	[5] 20. 00	[5] 28. 00	[5] 22. 00	[5] 27. 00
Storage [6]	[5] 8. 00	[5] 18. 00	[5] 6. 00	[5] 12. 00
Grading by commission agent [7]	[5] 100. 00	----------	----------	----------
Truck to Lawrence	24. 00	41. 00	24. 00	36. 00
Sorting charge: [8]				
Opening and dumping	75. 00	----------	30. 00	----------
Sorting	34. 38	----------	19. 94	----------
Scouring [9]	[5] 225. 00	----------	[5] 225. 00	----------
Combing, including scouring	699. 19	----------	1, 048. 03	----------

[1] Territory 64s, original bag, f. o. b., Denver, Colo.
[2] Australian 64s, skirted and graded, via West Coast or through Panama Canal.
[3] Boston Wool Trade Association, carlots of Territory wo .t of 40,000 pounds. All freight and trucking rates as of August 28, 1951.
[4] 25.5 cents per clean pound.
[5] Alternative services that may or may not be utilized.
[6] Charges for storing, etc., in dealer or commission agents' warehouse, as established by CCC Handler's Agreements, 1950.
[7] 1 cent per pound.
[8] Hourly wage rates of sorters at $1.72, hourly sorting rate for Territory at 500 lbs., for Australian at 860 lbs. The opening and dumping charge for Territory wools ranged from 0.5 to 1.0 cent per pound. The midpoint (0.75 cent) has been used here. For the variable charges of 0.3438 cent per pound for Territory and 0.1994 cent for Australian, the hourly sorting wage rate has been divided by the sorting output per hour respectively.
[9] $2.25 per 100 pounds.

Data supplied by Boston Wool Trade Association and other agencies in Boston.

Combing charges averaged 29 cents per pound of top for Territory as compared with 27.5 cents for Australian wool (table 20). But the proportion of the grease wool accounted for by offsorts was so much greater for Territory than for Australian wool that total charges for combing per 10,000 pounds of grease wool were much greater for Australian than for Territory wool. Shrinkage on matchings was greater for Territory than for Australian and net costs of $3.03 per pound of top from Territory wool compared with costs of $2.80 per pound, exclusive of duty, and $3.13, including duty, from Australian wool.

TABLE 20.—*Territory and Australian wool: Gross value and net cost of 10,000 pounds, by items, Massachusetts, 1951*

Item	Territory			Australian		
	Quantity	Price per pound	Value	Quantity	Price per pound	Value
Cost:	*Pounds*	*Dollars*	*Dollars*	*Pounds*	*Dollars*	*Dollars*
Wool used [1]	10,000	0.91	9,100.00	10,000	[2] 1.10	11,000.00
Sorting		.0175	175.00		.01	100.00
Total			9,575.00			11,100.00
Offsorts—credit:						
64s French combing	1,300	.92	1,196.00			
Low fleece	500	.90	150.00	300	.94	282.00
Fine Territory	250	.15	37.50			
Low	190	.13	24.70			
Stained	78	.60	46.80			
Grey-black fibers	40	.60	24.00			
Paint	2					
String	40					
Total	2,400		1,779.00	300		282.00
Matchings	7,600	1.0258	7,796.00	9,700	1.1153	10,818.00
Shrinkage [3]	4,180			4,850		
Combing charge [4]	2,411	.29	699.19	3,811	.275	1,048.03
Cost of matchings and combing charge			8,495.19			11,866.03

Combing waste—credit:						
Noil	[4] 459	1.90	872.10	[5] 569	1.90	1,081.10
Bar	100	.15	15.00	80	.15	12.00
Card	430	.20	86.00	380	.20	76.00
Laps	20	2.00	40.00	10	2.00	20.00
Total	1,009		1,013.10			1,189.10
Net cost			7,482.09			10,676.03
Top excluding duty		3.0328			2.7987	
Top including duty		3.0328			3.1333	

[1] Boston market quotations for week ending August 3, 1951; Wool Situation, July 1951.

[2] In bond.

[3] Shrinkage on matchings: Territory, 55 percent; Australian, 50 percent.

[4] 21 cents per pound of top plus ½ cent for 1 percent noil.

[5] $\frac{\text{Noil}}{\text{Top+Noil}} \times 100 = 16$ percent for Territory and 13 percent for Australian.

Based on data supplied by topmakers and manufacturers.

Direct savings in marketing and processing charges as indicated by the data presented in tables 19 and 20 do not show the full effect of ranch preparation on marketing and processing costs. They indicate possible savings in levies for physical handling at present levels of charges, but they show neither all the costs of marketing and processing nor how actual costs might be reduced by ranch preparation. An examination of all the major types of costs involved in marketing and processing wool as a basis for indicating the influence of ranch preparation on these costs may be helpful in evaluating the potentialities of ranch preparation.

BUYING AND SELLING

Perhaps the main cost not covered in tables 19 and 20 is that for personal services which include the selection, buying, and selling of wool. Although there are charges for these services (for example, broker's or commission agent's fee), they may include payment for services other than buying and selling, and they may obscure the effect of ranch preparation on the cost of the latter services. The nearest approach to a minimum charge for buying and selling alone is the broker's levy. For Australian wools this is usually about one-half of 1 percent. But at this charge broker's services can be used only when the quality and uniformity of preparation is so dependable that assorting and display of the wool is not required and inspection can be reduced to a minimum. Wool not so dependably prepared at the ranch is more often sold through commission agents who can prepare, commingle, and display it to buyers who come to inspect it in the warehouse. Thus, the costs of selling such wool are usually higher.

Costs of buying follow a similar pattern. If the quality and uniformity of preparation is assured, a buyer can limit his inspection to a sample of the lot. If preparation is inadequate, a detailed inspection is required. Competent buyers are scarce and their services are expensive. If they must be used for detailed inspections, the cost of buying becomes very high.

Costs to mills of buying grease wool include an element to cover the risk of uncertain outturn. Loss in outturn can be avoided only if shrinkage and quality are accurately estimated by the buyer. Such losses can be more closely estimated when wools have been made uniform in quality by skirting and grading as this tends to make them more uniform in shrinkage also. The buyer's allowance for error in estimating outturn must be widened further if the seller does not stand ready to make good any deficiencies found by the buyer.[30] A more detailed inspection is required in these circumstances.

Ranch preparation, therefore, may reduce the grower's cost of selling as well as the mill's cost of buying. Thus, the costs of buying and selling Australian wools are relatively low. Because of their

[30] An example of how closely the reputation of Australian wool is guarded was reported in an interview with a Boston topmaker. He had recently found one bale, in a lot of Australian wool, which was lacking in uniformity relative to the quality represented for the lot. The topmaker reported this to his local Australian broker, who instructed him to repack and return this bale to Australia, collect, as a means of checking the grower who packed the wool, in his preparation practices. This was done and the topmaker's purchase price was refunded on the bale.

consistently uniform preparation the broker and auction system can be used in selling and a detailed inspection by buyers is unnecessary. Similar low costs in buying and selling the larger clips from the Western States and Texas might be possible if preparation were adequate (*36*).

TRANSPORTATION

Better ranch preparation would probably affect the costs of moving wool to market very little. Established transportation rates make no distinction between prepared and unprepared wool and no savings in costs per 100 pounds result from grading and skirting. However, if heavy shrinkage tags were removed, the proportion of the value of the tagged wool that is accounted for by transportation costs would be reduced.

Possibilities of lowering transportation costs for wool by scouring it in producing areas are reduced by the higher freight rates per 100 pounds for scoured than for grease wool (table 21). With freight rates from Denver to Boston of $2.27 per 100 pounds for grease wool and $4.09 for scoured wool, a shrinkage of about 45 percent for the grease wool would equalize transportation costs per pound of clean wool. As shrinkage of Western wool usually is greater than 45 percent, it is apparent that transportation costs per pound of clean wool average somewhat greater for grease than for scoured wool. But these differences in costs are not great enough to offer much inducement to scour wool in producing areas, even if the scoured wool were readily acceptable to manufacturers.[37]

TABLE 21.—*Rail freight rates for grease and scoured wool by representative routes, August 28, 1951*

Route	Freight rate per 100 pounds [1]	
	Grease	Scoured
	Dollars	*Dollars*
Denver, Colo., to Boston, Mass.	[2] 2.27	[3] 4.09
Denver, Colo., to Charleston, S. C.	[4] 2.99	[5] 3.63
Boston, Mass., to Charleston, S. C.	[6] 1.94	[6] 3.02

[1] Wool in bags or bales, not machine compressed.
[2] Boston Wool Trade Association, minimum carlot 40,000 pounds.
[3] Union Pacific Railroad, 2d class rate, minimum weight 10,000 pounds.
[4] Union Pacific Railroad, minimum carlot 24,000 pounds.
[5] Union Pacific Railroad, minimum weight 10,000 pounds.
[6] Boston Wool Trade Association, minimum carlot 24,000 pounds grease wool, 10,000 pounds scoured wool. Rates for tops, shipped by rail, minimum carlot 25,000 pounds, from Boston to points in the Southern States are usually about 15 percent less than the rates for scoured wool. It was suggested that this lower rate for tops was available as a result of the large quantity of tops shipped South relative to the scoured volume.

Data supplied by Boston Wool Trade Association and other agencies in Boston.

[37] Boston wool buyers report that wool scoured in Western States is unsatisfactory because it mats in transit.

The effect of ranch preparation on costs of transportation may become more significant to Western growers as wool manufacturing expands in the South Atlantic States. By the direct route to the South which bypasses the Boston market, costs of transportation are much lower (table 21). For grease wool, the rate from Denver to Boston is $2.27 per 100 pounds and from Boston to Charleston $1.94, or a total of $4.21. From Denver direct to Charleston, the rate is only $2.99 per 100 pounds. The rate for scoured wool to Charleston is lower than it is to Boston—$3.63 to $4.09—a clear advantage for the direct route even before the Boston to the South rate is added. But the rate from Boston to southern points is usually about 15 percent lower for top shipments than for scoured wool. This is a special rate granted because of the heavy movement of top to the South.[38]

The Boston market, however, provides most of the preparation and marketing services needed in bringing Territory and Texas wools (as well as other domestic wool) to manufacturers.[39] As long as these services are supplied only by the central market, it is likely that wool from Western States, even though destined for mills in Southern States, will follow the less direct and more costly route through Boston. However, such freight differentials to the South as shown in table 21 may encourage growers to prepare more of their wool at the ranch and may encourage the expansion of western scouring and combing facilities that can serve the southern mills directly.

Scouring and combing facilities in the South are not yet sufficiently developed for the western grower to profit by shipping his grease wool direct. But as these facilities develop, the demand by southern mills for grease wool may increase. The demand is likely to be for well-prepared wool, however, because few preparation services are available in the South. Growers or their organizations may also need to provide more of the other marketing services than they now do, in order to take advantage of this market.

Some direct preparation and combing services for southern mills have been established. One manufacturer with plants in the South reported that he had found economies in buying Texas top direct.

HANDLING AND STORAGE

Although some wool is concentrated at warehouses in producing areas, large quantities are shipped to warehouses in central markets. Wool that is fully prepared on the ranch may be shipped directly to mills. Thus the use of warehouse services in central markets is avoided. But much domestic wool is concentrated at warehouses in Boston before it is sold. At the warehouses, the wool is assorted and put up in salable lots of more uniform quality, displayed in convenient form for inspection and sale, and given physical protection. Cost of

[38] As reported by the Transportation Department of the Boston Wool Trade Association.

[39] Boston provides a much wider range of services in marketing domestic than in marketing imported wool. The activities of the Boston central market have declined as a result of the decline in domestic production. The increase in imports that accompanied this decline has not brought a corresponding increase in marketing activities, because imported wools require little preparation, their financing is usually by letter of credit of the mills, and they can be handled readily by brokers.

storage alone is a minor item in the total cost of services at these warehouses. The storage charge allowed by the Commodity Credit Corporation for Territory and Texas wool in 1950, for example, was 8 cents per 100 pounds per month.[40] Physical handling, grading, and inspection services account for most of the warehouse cost. As most of the handling is manual, costs of labor become large when wool is handled two or more times in preparing it for sale. Handling charges allowed by the Commodity Credit Corporation in 1950 ranged from 1.25 cents a pound for lots of more than 5,000 pounds to 3.50 cents for the smaller lots.[41] Many handling services could be eliminated if the wool arrived in central markets in large lots of uniform quality.

GRADING

Grading of wool as a basis for sale by producers has increased in recent years, but most of the domestic clip is graded at warehouses in central markets such as Boston. Grading in central markets is done mainly by dealers and commission agents who sell wools to mills. Only in exceptional cases do manufacturers or commission scourers and combers grade wool as a separate operation. When stocks require it, grading is done by manufacturers as part of the sorting operation.

Dealers make no separate charge for grading because they buy and sell wool on their own account, but the cost of this service is included in their gross operating margin. Agents who sell on a commission basis ordinarily charge a flat rate of 1 cent a pound for grading, usually without regard to the size of the lot graded or the number of sorts made. This grading includes assorting the fleeces, weighing and storing each grade separately, and cleaning up after each clip or lot is graded.

Graders from commission agent and dealer houses are sometimes sent out to warehouses in producing areas during the shearing season when the Boston market is inactive. Wools in farm-flock States are often graded by these men. Farm-flock wools usually need a great deal of assorting because of the many small lots. The National Wool Marketing Corporation reported sending its Boston graders to warehouses in the Western States in recent years with successful results. Charges for grading were levied on the basis of costs of travel and labor and gave significant savings to growers over the flat 1 cent per pound charge.[42]

One advantage held by consignment and dealer houses over growers, is their ability to keep a skilled staff of graders employed virtually the year round. Graders employed exclusively on ranch grading in the West would have some difficulty here. In Boston, graders and their skilled helpers are employed on general warehousing duties when they are not required for grading. This ensures a supply of skilled labor when it is needed. In the rush season, unskilled helpers are employed who can be laid off when operations are slack.

The influence of size and other characteristics of lots on the rate and cost of grading wool may be indicated by data relating to grading

[40] Commodity Credit Corporation, Handlers' Agreement for 1950.
[41] Commodity Credit Corporation, Handlers' Agreement for 1950.
[42] Interview with the manager of the corporation in Boston.

at large consignment houses in Boston in 1951. These data show that the output for a grading team, consisting of one grader and five helpers, ranged from 10,000 to 20,000 pounds of wool per 8-hour day. The lower limit of 10,000 pounds was the output when wool from small flocks, yielding only a few hundred pounds of wool of varied quality and poor preparation, was graded, and for which the identity of each lot had to be maintained. When the wool was in large lots, had only three or four grades, could be commingled, and was well put up, except for grading, as much as 20,000 pounds a day could be graded. Cost of the labor service of graders and helpers averaged 0.74 cent a pound for grading small lots and 0.37 cent for grading large lots.

These results indicate that the flat charge of a cent a pound for grading lots of different size and diversity does not reflect the actual costs of grading wool in central markets. Such charges make it more difficult for growers to compete with central markets in grading small lots and encourages grower preparation of large uniform lots. Satisfactory grading at the ranch would eliminate the flat charge of a cent a pound for grading in central markets, a part of which apparently would represent a net saving to producers. Records compiled by the Texas Agricultural Experiment Station show that costs of grading and tagging wool at the ranch in 1948, 1949, and 1950 averaged 0.25 cent a pound for clips which averaged 14,000 pounds each. If these costs are fairly typical for ranch grading of large clips, substantial savings to growers may result from such grading.

SORTING

As indicated earlier (p. 32), sorting is the process of dividing or assorting the wool in each fleece on the basis of quality. For wool that is fully prepared by skirting and grading at the shearing shed, sorting may consist of no more than superficial checking as the wool goes into the blend, to ensure that the quality is consistently uniform. With poorly prepared wools, sorting must be more detailed and the rate of sorting is lower. For most common blends, however, skirting done at the ranch fills about the same role as sorting in the mill. If combined with effective grading at the ranch, skirting would eliminate much of the extra labor involved in sorting inadequately prepared wools. The value of this saving may be indicated by the cost of the additional sorting labor that would be required.

In addition to varying with the degree of preparation, the costs (and charges) of sorting also vary with the size of the lot, with the particular blend sorted, and with the limits allowed in the range of variation of the blend. Rates charged for the actual sorting (aside from opening and overlooking) depend mainly on the labor costs involved and are thus closely related to the degree of preparation of the wool as it is received at the mill. Some commission combing mills, for example, make a fixed charge for opening and dumping the wool, regardless of its preparation, and an additional charge which varies with the extent of sorting required. This added charge depends directly on the degree of preparation and gives, therefore, a first approximation to the saving in cost of sorting that could be made by ranch preparation. For original bag Territory and Texas wools, fairly detailed sorting is required, according to reports of combing plants, and the variable charge levied in 1951 averaged a little more

than 0.34 cent a pound (table 19, p. 63).[43] For most Australian wools, the additional charge of 0.20 cent a pound was lower because they could be trap-sorted, that is, the wool could be passed directly into the blend with only a superficial overlooking.

Another possible saving in the cost of labor that ranch skirting may effect would result from enabling the use of mechanical conveyor belts in sorting to move the wool from open bags to storage bins. Some combing plants and topmakers use these belts, but only when the degree of preparation of the wool warrants it. There is usually no advantage in using them for poorly prepared wools because their lack of uniformity and the large number of sorts would mean stopping the belt repeatedly to give sufficient time for sorting. For Territory and Texas wools, which are above average in preparation, and for most foreign wools, it was reported that the use of conveyor belts increased the output and decreased costs significantly.

This was illustrated by data obtained from mills on the sorting output for various types and preparations of wool (table 22). By combining and averaging the data from different mills, an average hourly sorting rate per worker was obtained for the major types.[44]

TABLE 22.—*Output per sorter for domestic and foreign wool, by types* [1]

Type of wool	Description of wool sorted	Sorting output per hour	
		Manual only	Belts and manual
		Pounds	*Pounds*
Fleece (Ohio delaine, etc.)	Numerous strings, 7–10 sorts, tags, trash, etc., not graded or skirted, small bags poorly packed, 30–40% offsorts.	150–190	(2)
Territory:			
Fine	One string, partly tagged, 5–6 sorts, not skirted but partly graded, 15–20% offsorts.	200–300	500–600
Half Blood		---	450
⅜ and lower		---	190
South American:			
Montevideo	Not tied, mostly tagged, partly skirted, graded 5–10% offsorts.	400–500	720
Punta Arenas		400–500	---
Australian	Not tied, skirted and well graded, 1–3% offsorts.	500–850	850–1200
South African	Mostly skirted and well graded, 1–5% offsorts.	500–600	850–1000

[1] Derived from data obtained in interviews with commission combers and worsted manufacturers.

[2] Not suited to belts.

[43] Sorters in combing mills reported that most Territory wools required tagging and this operation reduced the output of the sorters considerably as they were expected to pull as much wool as possible out of the tags before disposing of them.

[44] Mills vary in sorting output per man. Variations among mills can be attributed chiefly to differences in specification of blends commonly sorted, differences in duties attached to the sorting operation (some sorters dispose of their offsorts, others do not), variations among workers, and incentive pay plans.

Differences in sorting rates are accounted for by differences in condition of the wool. Strings, especially when the fleece is tied with more than one, reduce the rate of output. The rate is low, also, when the number of sorts and the volume of offsorts are large, when the wool is not tagged, graded, or skirted, and when the lots are small. The rate increases considerably when belts can be used. For Fine Territory wool, the rate was reported as doubled with belts, while for foreign wools it almost doubled. Combing firms reported, however, that Territory wools usually have too many sorts and too large a proportion of offsorts for belts to be used effectively. Australian wool is received skirted, usually has only 1 to 3 percent of offsorts, is graded and has no strings, and thus is suitable for conveyor sorting.

These data relating to sorting rates indicate that differences in preparation support the variation in charges that are made for sorting in combing mills. They lead, also, to the conclusion that differences in sorting charges between prepared and unprepared wool (that is, the difference between 1.09 and 0.50, or 0.59 cent, as shown in table 19, p. 63) may be less than the full saving that might be gained by ranch preparation. If the sorting rates for Territory wool were increased from 200 to 500 pounds an hour (table 22) by adequate tagging and grading at the ranch, which would permit sorting on conveyor belts, the labor cost of sorting would be reduced from 0.86 to 0.34 cent [45]—a reduction of more than a half cent a pound. If, in addition, the output could be increased by ranch skirting to the rate of Australian sorting (850 pounds and up), the cost would fall to about 0.20 cent, giving a total reduction of almost 0.66 cent a pound.

COMBINED EFFECT OF RANCH PREPARATION ON LABOR AND CAPITAL INPUTS

As a final step in summarizing the effect of ranch preparation, the major changes in central market labor inputs have been brought together to show the result on grading and sorting costs combined (table 23). For these two major operations, labor services comprise virtually all of the inputs involved and the cost of these labor inputs closely approximates the total effect of ranch preparation on costs of grading and sorting in the central market. The labor inputs and wage rates used are those reported by firms grading and sorting in the Boston market during the summer of 1951.

[45] Using 1951 hourly wage rate for sorters of $1.72.

TABLE 23.—*Estimated input and cost of labor for preparing 10,000 pounds of territory wool for scouring, Boston market area, 1951*

Item	Graded and skirted clip		Ungraded and unskirted clip	
	Labor	Cost	Labor	Cost
Grading and sorting:	*Hours*	*Dollars*	*Hours*	*Dollars*
Grading	[1]	[1]	[2] 5.33	[3] 49.04
Sorting	[4] 11.8	[5] 20.30	[4] 33.30	[5] 57.28
Opening and dumping		[6] 50.00		[6] 75.00
Total		70.30		181.32
Cost per pound:				
Grease basis		.00703		.01813
Scoured basis		.0156		.0490
	Percent		*Percent*	
Shrinkage	55		63	

[1] No grading required.
[2] At a grading rate of 15,000 pounds per 8-hour day.
[3] Hourly wages: One grader at $1.80 and five helpers at an average wage of $1.48, or a total hourly wage bill of $9.20.
[4] At sorting rate of 850 lbs. per hour for the graded, that is, just "thrown down the trap," and 300 lbs. per hour for the originally ungraded wool, because it is not skirted and so must be more thoroughly sorted.
[5] At $1.72 per hour.
[6] See table 19, p. 63.

Calculations based on the labor inputs required to prepare a skirted and graded clip of 10,000 pounds of Territory wool for scouring versus the inputs for an ungraded Territory clip of the same weight are presented (table 23). The prepared clip is assumed to be well graded, tagged, and skirted, and to contain only one fairly narrow grade. The ungraded clip is presumed to be only partly tagged, unskirted, of seven or eight grades, about 2 percent of grey fleeces and 2 percent of burry fleeces scattered throughout the clip, tied with one or more strings, and shipped by the grower with instructions that the clip be graded if necessary but not commingled.[46] The skirted wool is presumed to be eligible for 64s grade and to be of Staple to Good French Combing length. The ungraded is assumed to vary from 58s to 64s and from Strictly Combing to Clothing length.

The only labor inputs required for the graded and skirted clip are for opening, dumping, and overlooking. For the ungraded clip, on the other hand, the cost of labor inputs for grading are almost 0.5 cent per grease pound, and additional costs of opening, dumping, and sorting are 1.3 cents a pound. In terms of labor inputs, therefore, the cost of grading and sorting in the central market is 1.8 cents per grease pound. But a part of these costs would be incurred for well-

[46] For purposes of the example, the ungraded clip was designed to represent the average of preparation reported for Territory clips as a whole, both large and small.

prepared wool, also. The net reduction in cost of labor inputs that would come from skirting and grading on the ranch, therefore, would be $111.02 on 10,000 pounds, or 1.1 cents per grease pound (table 23).

Other possible reductions in central market costs may be summarized here. As the well-prepared clip can go directly to the mill for processing, it may avoid both storage in a Boston warehouse for grading and one of the truck transshipments. The cost of buying may be much lower because the well-prepared clip may be sold on sample, rather than inspection—especially if the seller can guarantee its quality. Because it would change hands fewer times, the cost of buying may be still further reduced.[47]

In addition, the ranch-skirted wool is likely to be more uniform, after sorting, than the unprepared wool. For the latter, the bagging and shipping from the ranch and the opening, grading, and rebagging in the Boston warehouse tend to mix the lower grade skirtings with the higher grade sorts and they cannot be effectively separated again, even in sorting. Thus a skirted and assorted clip shipped to a manufacturer will provide him with more of its top-quality wool than if it were shipped ungraded and required grading by a commission agent before reaching the mill.

When these additional savings are added to the reduction in costs of grading and sorting, it may be concluded that ranch preparation might reduce the costs of marketing and processing by more than 1.1 cent a pound. These reductions in costs, together with a probable improvement in quality, would doubtless mean that marketers and manufacturers could pay higher prices for wool properly prepared on the ranch. Whether they would be willing to do so is likely to depend upon whether they prefer to have wool prepared on the ranch or in the central market. Their preferences are examined next.

Acceptability of Ranch Preparation to Marketers and Manufacturers

Regardless of any reductions in the costs of marketing and processing that would result from improved ranch preparation, returns to growers are unlikely to be increased as a result of such preparation unless these reductions in costs are reflected in relatively higher prices to producers. Before buyers can afford to pay these relatively higher prices, ranch preparation must be acceptable in two respects: (1) It must meet the technical standards required by wool manufacturers, and (2) it must thereby enable buyers to sell the wool at prices high enough to maintain or increase their profits. Only under these circumstances is it likely that buyers would be willing to pay more for wool that has been prepared at the ranch. The preferences of buyers in both of these contexts will now be examined.

PREFERENCES AS REPORTED

Preferences of buyers, as to preparation reported in the field survey of manufacturers, topmakers, and dealers, reveal the significance to

[47] The number of changes of ownership through which a product passes is usually directly related to its cost of marketing and to the spread between what the grower receives and what the consumer—in this case the manufacturer—pays (*1*).

growers of acceptability from the viewpoints of manufacturers and marketers.[48] In the survey, a sample of 17 manufacturing firms was interviewed. Only 7 of these firms used any grease wool.[49] The seven firms using grease wool were large, however, and controlled many plants that were above average in capacity. These plants made up about 10 percent of the plants in the country as a whole, as reported in the 1947 Census of Manufactures and consumed almost 20 percent of the 1950 consumption of wool. Replies were based on 1950 data. They were asked to state their preferences for ranch preparation of Territory wool. Six of the seven said they would prefer to buy Territory wools prepared on the ranch like Australian wools. One firm used only Australian wool and did not report its preferences for Territory preparation. When asked whether they would prefer to have Territory wool skirted by growers in the Western States, however, all of the six firms said "No." Three firms favored grading of Territory wools by growers. All six preferred to have them more effectively tagged by growers.

Five of the largest topmaking firms were asked their preferences in the preparation of Territory wool.[50] Three topmakers preferred to buy it in the "original bag" form, that is, as it comes from the shearing floor, ungraded and unskirted. Two preferred to buy it in a fairly narrowly graded line. The three who preferred original bag wool based their preference on: (1) Being able to assort and prepare the wool for blends at a lower cost than could growers or other market agencies, and (2) being able either to use all the offsorts (that is, tags and skirtings) or to sell them advantageously. The two who preferred the wool in graded form based their preferences on a desire to eliminate the problem of offsort and tag disposal because they specialized in making top only and not in trading in these off wools. One topmaker said he would prefer Territory wools to be both well skirted and graded. There were indications that the other four were inclined to favor the skirting and grading of Territory wools to a greater extent than they had in the past.

A few dealers and commission agents were interviewed and all said they preferred ungraded or original bag wool. The reason given for their preference was their superior competence. They said they thought that, compared to growers or others not active in the central market, they were more competent to judge the grading and preparation needs of manufacturers.[51]

Manufacturers apparently favor improved preparation of Territory wools on the ranch more than do topmakers and dealers. The

[48] Methodology and scope of the field survey are given in the Appendix, p. 84.

[49] Of the remaining 10 firms, 4 used scoured wool only, 5 used top, and 1 used yarn.

[50] Although the number of topmakers in this sample is not large, the estimated and reported handlings of these five firms approximated 25 percent of the top made for sale in this country.

[51] A common statement of Boston dealers and commission men was: "Grading should be left to those who are in touch with the trade's requirements." No doubt, there is much validity in this general statement, but it implies that grading should be done in the Boston market, and this may not be equally valid. Grading can be done as well at the ranch as it can elsewhere, provided it is supervised by one who knows the market requirements. In Australia, ranch grading is supervised by a classer who has been approved by one of the Australian wool houses (*54*, pp. 311–312).

differences in preferences of manufacturers and some topmakers—setting aside dealers for the time being because they do not comb wool—cannot be explained by differences in the technical requirements of these two types of firms. It must be explained by other factors because their technical requirements are virtually the same. Both manufacturers of worsteds and topmakers require the same degree of uniformity in the wool stock when it is ready for scouring before combing. For the most part, both make the same kinds of top. Top for specialty products is an exception but this is not a large proportion of the total. Most of the top made is of standard quality, designed for the mass market, and requiring a relatively consistent degree of preparation.

Manufacturers of woolens similarly require a highly uniform stock whether of fleeces, offsorts, wastes, or reclaimed wool. Specialty fabrics are common in the manufacture of woolens and a wider variation in degree of uniformity may be allowed in some of the stock required for these fabrics.

FACTORS THAT INFLUENCE PREFERENCES

An examination of the factors that influence the preferences of particular types of firms reveals that these preferences stem from a variety of sources. Custom and habit often fix preferences so rigidly that they resist change. If a manufacturer or topmaker has become accustomed to handling wool prepared in a certain way, he will tend to prefer that preparation because anything different would mean changing his methods of operation. Those firms who are familiar only with central-market preparation are thus unlikely to prefer ranch preparation.

A change in the main source of supply tends to cause changes in preferences when the degree of preparation is also altered. The increased use of well-prepared Australian wools during the 1940's is an example. Many manufacturers and some topmakers who use Australian wools have adjusted their techniques to the extent that, except for a superficial overlooking, sorting is virtually eliminated. The fact that sorting, scouring, and combing have shifted from manufacturers of worsted to topmakers and scouring from manufacturers of woolens to dealers, shows that manufacturers now prefer the well-prepared wools.

Facilities available to firms may also affect their preferences. Manufacturers who do not have grading and sorting facilities prefer a well-prepared wool. Dealers and topmakers utilize facilities which, for the most part, they neither own nor operate. They use the services of graders, sorters, scourers, and combers that are for hire in the central market. Thus, they are able to handle effectively the most poorly prepared wools—as well as those well prepared. Under these circumstances, it would be expected that preferences would not be closely limited to any particular kind of preparation. But most dealers and some topmakers usually prefer unprepared wools. Their preferences are conditioned more strongly by factors other than their mode and habits of doing business.

For at least 30 years, commission, dealer, and topmaker firms in the central market have provided the major part of the preparation

and marketing services for domestic wools. These firms have done most of the assembling, shipping, storing, tagging, assorting, grading, scouring (in recent years especially for the woolen manufacturer), as well as the buying and selling of wool.[52] The marketing organization of these firms is designed to encompass as many as possible of the marketing and processing functions that intervene between growers and spinners.

A major factor in the development of this dealer and commission-agent organization can be found in the manufacturers' need for some agency to rectify the defects of domestic wool preparation. This demand for their services in the past has persuaded them that all of these services still need to be performed, preferably in the central market. Each additional service they perform contributes to their overall bargaining and profit position. Ranch preparation would reduce this market power (of which more is said later) as well as their market functions. Their preferences indicate that they are not prepared to forego the opportunities for profit in their traditional role in favor of ranch preparation.

Preferences of topmakers reflect to some extent an origin similar to that for dealers. Expansion in number of topmakers in the 1930's stemmed from the organization of dealers that arose in the 1920's. Many of these firms had their origin in large dealer houses of the earlier period. The operations of such topmakers tend to follow those of dealers except that they carry the processing one step farther. Preferences of such firms with respect to preparation of wool tend to parallel those of dealers.

IMPLICATIONS OF PREFERENCES

Preferences of manufacturers, topmakers, and dealers, in the form in which they were reported in the field survey, do not indicate just how far ranch preparation needs to be carried to meet market requirements effectively. An evaluation of their implications in terms of the factors that influence them may provide some insight into this problem.

Preferences of manufacturers may reflect mainly processors' requirements and only indirectly the effectiveness of ranch preparation in meeting these requirements. If manufacturers bought wool directly from growers instead of from dealers or topmakers, their preferences probably would reflect more directly the adequacy of ranch preparation. None of the seven manufacturers interviewed who buy grease wool, bought it directly from producers. Only two said they bought even small parts of their grease wool from dealers in the Western States. The other five bought all of it from dealers and topmakers near Boston. All said they depended on dealers and commission agents for assorting and grading Territory and Texas wools and for insuring satisfactory grade and putup.

As mentioned previously, dealers and some topmakers prefer unprepared wool. They believe they can buy it and prepare it for manufacture more satisfactorily and at lower cost than they could buy such wool skirted and graded on the ranch. This belief is based

[52] Not all of these dealer services are needed for well-prepared imported wools. Broker services are sufficient.

partly on training and experience and on the economies of scale these firms have developed through bulk handling. It may be based partly on disadvantages to their bargaining position which they think would result from ranch preparation. Experienced buyers for dealers and topmakers have a greater advantage over growers in judging the value of poorly prepared wool than of wool that has been well assorted and classified on the basis of established standards.

Differences in preferences between manufacturers and dealers and topmakers do not indicate differences in the kinds of preparation needed to meet processing requirements. Differences in the preferences expressed may be attributed mainly to differences in position and function of the agencies and the way they are affected by ranch preparation. As manufacturers seldom buy wool directly from growers, their interest in ranch preparation relates mainly to the influence of such preparation on the uniformity of the wool obtained from dealers, commission agents, and topmakers.

The acceptability of ranch preparation of wool rests mainly in the hands of dealers, commission agents and topmakers, most of whom, as previously indicated, prefer not to have wool prepared on the ranch. These firms are in a strong position to make their preferences effective in the market because they buy most of the wool from producers. Consequently, the value added by grading and skirting wool on the ranch may not be reflected in relatively higher prices to producers unless the quality and dependability of ranch preparation is such that it will be readily accepted by dealers, commission agents and topmakers or directly by manufacturers.

GUIDES AND MEANS TO EFFECTIVE RANCH PREPARATION

Stated preferences of manufacturers and topmakers with regard to the preparation of wool may be used as a guide in ascertaining the kinds of preparation which most effectively meet manufacturers' requirements and in indicating how growers may provide them. Manufacturers' preferences appear to give a fairly clear indication of the kind of preparation that is needed. Their preferences are not qualified by the belief that it is more profitable to prepare the wool in their own plant. Manufacturers of worsted yarns, and probably an increasing number of topmakers, prefer to have Territory and Texas wools, at least, skirted and graded like ranch-prepared Australian wools. Manufacturers of woolens usually prefer scoured wools, but those who buy fleeces in grease form prefer them unskirted, that is, in original bag.

As most Territory and Texas wool is suitable in fineness and length for worsted manufacture, and the value in such use is higher than in woolen uses, growers can meet manufacturers' preferences most fully by skirting and grading on the ranch all wools suited for worsted combing. Only when wools are too coarse or too short for worsted manufacture is there a preference for unskirted fleeces. But even these unskirted wools, which are used in the manufacture of woolens, need to be well tagged. They should also be comprehensively classified in order that buyers may know their qualities. This could well be done, also, for the skirtings from those fleeces prepared for the manufacture of worsteds.

Uniformity of quality is the major factor in meeting manufacturers' requirements. Tagging or grading alone, for example, is not sufficient preparation unless the remaining wool is already of such consistent quality that these operations make it uniform. Only in exceptional cases will tagging or grading alone make the wool sufficiently uniform for the manufacture of worsteds.

Ranch preparation must, therefore, fill two requirements if it is to meet the needs of manufacturers and topmakers. It must make the wool sufficiently uniform and it must be dependable. The fact that manufacturers prefer Territory and Texas wools to be skirted and graded but are unwilling to depend on growers for such preparation illustrates these requirements. Because grower preparation has been somewhat inadequate in the past, manufacturers do not realize that the necessary skirting and grading could be done effectively on the ranch.

This attitude can be explained by two factors: (1) Growers in the Western States and Texas have had too little opportunity to learn the needs of manufacturers and topmakers or the techniques of fitting their wool to meet these needs; (2) coordination of the practices used in preparing wool have not been sufficient to ensure uniform and dependable preparation by growers. The importance of both of these factors warrants further emphasis. The role of extension work among growers in the Western States should be stressed if these growers are to know how to prepare their wool adequately. Such extension work would need to make clear the kind of assorting and grading necessary and the degree of uniformity required. It could well include both grower information and the training of skilled operatives.

Despite the value of increased extension work, however, preparation by growers is not likely to be acceptable to manufacturers and topmakers until growers' practices are coordinated. Each individual grower may prepare his wool carefully but, unless a single standard can be made effective, there is likely to be much variation among growers. Skirting and grading cannot be consistent when each grower depends on his individual judgment in deciding whether his preparation is suitable. To present large uniform lots of wool for sale to manufacturers, growers need to coordinate both their methods and standards of preparation. Otherwise, much of the preparation would need to be done over again by central market agents.

Some competent and unbiased agency may be needed to supervise the grading and skirting of wool in producing areas to assure buyers and others that the quality of this preparation is both uniform and dependable. The critical decision in ranch preparation may turn less on the costs of preparation than on whether growers are guided by a central authority similar to the brokers' associations in Australia and New Zealand.

MARKET STRUCTURE AND ACCEPTABILITY OF RANCH PREPARATION

If growers do meet mill requirements by presenting a uniformly well-prepared wool on the market, they may be unable to obtain in local markets the value added by improved ranch preparation. Although the final users of Territory and Texas wool prefer that it be well prepared, growers usually sell to dealers and topmakers or through commission agents who oppose ranch preparation and who

may be unwilling to pay relatively high prices for wool well prepared at the ranch. Possibilities for individual growers to obtain the full benefits of ranch preparation of their wool depend to a large extent on the structure of the market and the conditions under which wool is produced and marketed.

The market structure in the wool-growing industry is characterized by small-scale, specialized, and widespread production units; by markets, processors, and consumers located far from production areas; and by lack of control of the quantity and quality marketed by growers as a whole. With such a large number of small producing firms (farms or ranches) each individual firm can influence the market price very little. Within such a market structure a grower sells his wool under conditions approaching pure competition. He decides upon the time and place of sale, but even these decisions are often confined to relatively narrow limits as a result of physical or economic factors. In the main, an individual grower has little scope for making marketing-policy decisions. Most of the improvements he could make in marketing efficiency would be costly or wasted effort unless most other growers followed his lead. Exceptions in this structure are found in direct selling by growers, marketing organizations of growers, and government-sponsored group activities.

There is a basis for believing that firms engaged in assembling and processing wool may be able to take advantage of some elements of imperfect competition. They are more experienced than growers in judging shrinkage, grade, and bargaining resistance. They are more closely in touch with the market and the price situation and they may be backed by a principal large enough to influence the market price for wool. A few dealers and topmakers in Boston handle a very large part of all the wool produced.[23] Their decisions as to price can significantly affect the price received by the grower and the price spread between prepared and unprepared wools. They are unlikely to offer more for prepared wools than their own costs of preparation. They may offer less, because they are not likely to encourage a change in grower practices that will force them to alter their traditional methods of handling Territory and Texas wools and that will, at the same time, reduce their functions. It is the market power of these firms that individual growers must face in bargaining for the value added by ranch preparation. Although manufacturers seldom buy from growers, the situation would not be significantly different if they did, because only a few very large firms buy grease wool.

A dealer on the Boston market has other advantages stemming from his strategic position that a grower who sells from his ranch does not have. The former has an established reputation on which the manufacturer he serves can depend. He is likely to handle particular types of wool, prepared in a way satisfactory to particular manufacturers. In other words, he sells differentiated products and preparation services to which manufacturers have become attached. Manufacturers are willing to pay for such products and services.

[23] In 1938, a Senate investigation of dealer activities disclosed that "the five largest dealers handled 33.6 percent of the (total U. S.) clip; 10 dealers handled 48.5 percent; 15 dealers handled 57.6 percent; 20 dealers accounted for 67.4 percent; 25 reported 72.9 percent of the total volume; and 50 dealers handled 86.8 percent of the total production". The number of dealer firms in the Boston market has declined since 1938, but information could not be obtained, in this survey, on the volumes handled by firms in 1950 (*49, 50*).

But a grower can offer little in the way of differentiation of either product or services. His reputation cannot be significant when his clip is only a small part of the total purchases of most buyers. His preparation is mostly unacceptable because it has not been harmonized with preparation by other growers. Prices for wool are established in Boston, New York, and other central world markets. From the viewpoint of an individual grower, such price-making conditions approach pure competition. He has little or no opportunity under such conditions to affect his returns (1) by varying the quantity or quality that he, as an individual, places on the market, (2) by differentiating his product by brands, superior preparation, or packaging, or (3) by influencing the volume of his sales by advertising, or special services to buyers.

There may be limited opportunity for individual growers to obtain special premiums from particular buyers when they have established a reputation for proper preparation through years of association. But such opportunities are unstable relative to the supply of wool as a whole. If the grower decides to sell to a different buyer he loses any advantage he may have had. In the main, a grower in the Western States and Texas is unlikely to increase his returns by grading, skirting, and selling his wool on an individual basis. And unless he can become a member of a group working together, he will seldom gain by preparation. Only when the preparation of a significantly large part of the supply is improved can it be an influence in improving the price to the producer.

Returns to individual growers may be influenced by changes in marketing practices only when growers are able to coordinate their activities. Because of the structure of grower marketing such a coordinated policy can only be accomplished by voluntary organization or by intervention through a central authority such as the Federal Government. The coordination of preparation and selling decisions through voluntary organization may be attained through grower cooperatives, voluntary adherence by growers to the supervision of grading and preparation on the ranch such as is exercised in Australia by the large wool-marketing houses (*54*, p. 312), acceptance by growers of some final arbiter of the adequacy of preparation for the market (such as the wool brokers' associations in New Zealand and Australia) (*28*, p. 72; *2*, p. 73), or by other means. Opportunities for intervention in marketing activities through a central authority such as the Federal Government would include in addition to Government price-support and marketing programs, extension work in marketing methods, establishment and enforcement of official standards for grading, an official grading service, and provision of market news.

Marketing research and extension, if aimed toward improving returns to the grower by ranch preparation, will probably need to be directed toward either group activity or Government intervention. If the structure of marketing is changed and conditioned by either of these to the extent that the grower can obtain the value added by ranch preparation in the market, it will be to his interest to change his marketing or preparation practices. To the extent that voluntary group activity or Government intervention is successful, the grower is released from the confines of his "atomistic" market structure.

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APPENDIX

METHODOLOGY OF SAMPLING IN THE FIELD SURVEY

The field survey sample comprised a partially random selection of woolen and worsted plants in the New England States as listed in Davison's Bluebook, 1950, a directory of textile manufacturers (*51*). This directory lists 101 worsted and 282 woolen manufacturing plants. A 10-percent sample was selected—10 worsted and 28 woolen plants. Officials of the firms controlling the selected plants were then interviewed.

Specialized woolen mills, which are more numerous than worsted mills, are mostly small and widely dispersed throughout New England. When the early interviews indicated that these woolen mills used very little raw wool, extensive field interviews appeared likely to yield diminishing returns. The scope of the woolen mill survey was therefore restricted and two additional worsted plants were selected. In all, the officials of 26 firms were interviewed. These included 5 topmakers, 5 primarily woolen manufacturers, 12 primarily worsted manufacturers, 1 commission scourer, 2 commission combers, and 3 firms engaged primarily in marketing wool.

Some of the factors that limited the random character of the survey should be noted. Because the data on an individual plant basis were not available from individual firms controlling a number of plants, the activities of the whole firm were recorded in the interviews, even though some of the firm's plants had not been drawn in the sample. This may have given some bias to the sample but it also greatly expanded the volume of wool consumption to which the study applies.

The 17 woolen and worsted manufacturers interviewed represented 77 plants, or about 10 percent of the number of plants reported in the 1947 Census of Manufactures. Their estimated consumption of wool in 1950 was almost 25 percent of consumption in the country as a whole. When it was found that all plants selected could not be visited, the survey was restricted to interviews with officials in Massachusetts, Rhode Island, and New Hampshire. Eighty-five percent of the worsted plants and 70 percent of the woolen plants in New England are in these three States, however, and most of the larger firms visited had plants in other States, so the geographic restriction of the sample is not believed to have given it a serious bias.

A third limitation on the sample was found in the structure of intrafirm specialization in the industry. Large firms with many plants, each of which specializes in a particular product, ordinarily buy many types and preparations of wool, but the identity of the wool is lost in the intrafirm transfers and blending and could not be linked directly to the particular type of production in any one of the plants.

These three factors restricted the wholly random nature of the sample. A representative sample would be difficult to devise, however, unless it was very large. Because of the continuous variation in the techniques and organization of firms (which is the hallmark of the industry) as well as the tendency of firms to differentiate products by plants, a small sample cannot be expected to give a wholly adequate description of the industry. Despite these limitations, therefore, it is believed that the sample taken is reasonably representative of wool manufacture in New England.

Glossary

This is a partial glossary of terms used in the wool industry.[54] It is designed as a reference for definitions of such terms appearing in this report.

Alpaca.—A fine lustrous fiber obtained from the fleece of the Alpaca, a domesticated animal of the llama family native to the high Andes region of South America.

American system.—A system of worsted spinning developed by a machinery company as an outgrowth of their work on equipment for spinning rayon staple.

Apparel wool.—Suitable for making clothing or apparel, as distinguished from carpet wool.

Bale.—Compressed package of wool. A dumped bale is one that is highly compressed.

Bellies or belly wool.—Coarse quality of wool from the underside of the sheep.

Black wool.—Entirely or partly colored. An occasional black fiber in an otherwise perfect fleece will class it with the greys. Sometimes all off-colors, as browns and greys, are thrown into one off-color sort designated as "blacks."

Blending.—Mixing two or more lots of sorted wool; mixing wool and cotton, shorn wool and shoddy, etc.

Bradford system.—The system of combing and spinning wool now generally employed in England and largely used in the United States. For this system, wools of longer staple are needed than those used in the French system. The latter makes a softer but weaker top and yarn.

Braid wool.—Long, coarse, and strong wool with luster and braiding quality.

Britch (breech) wool.—The coarse, lowest grade of the wool in the fleece taken from the lower portions of the hind quarters.

Burling.—An operation in which worsted fabrics are inspected and foreign matter removed from the cloth by hand.

Carding.—A manufacturing process that converts loose scoured wool into a continuous strand suitable for subsequent operations.

Carding wool.—Short wool suitable for woolen manufacture.

Carpet wool.—Coarse, hairy wools used in making floor coverings.

Classing (wool).—The allocation of the fleece to any particular standard quality, according to its quality or qualities. It may be considered as the preliminary sorting.

Clean value.—Market value of the wool after all foreign matter has been removed by scouring.

Clean content.—The yield of clean scoured wool from a given quantity of fleece after allowance for any vegetable or other foreign matter which may be present after scouring.

Clothing wool.—Too short to comb economically.

Combing.—A straightening of wool fibers, and the extraction of shorter lengths (noils) and of small particles of vegetable matter clinging to and tangled with the wool, from the continuous rope-like strand of long, parallel fibers (top), which is used for making worsted yarns.

Combing wool.—The longer wool suitable for worsted yarns.

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[54] The chief source of the definitions used here was Wool Prices, Comparative Prices and Price Differentials on Domestic and Foreign Wools together with a Comprehensive Glossary of Wool Terms, U. S. Tariff Commission, Report 120, Second Ser., Washington 1937 (52). The Handbook was the source for the additional definitions (54).

Condition.—The amount of yolk or dirt in grease wool. Wool is heavy conditioned if it contains large amounts, light conditioned if it contains small amounts.

Contour.—The shape of a cross-section of the wool fiber.

Core test.—A method of testing packaged raw wool for shrinkage. A boring tool extracts samples from various parts of each bag in the sample. A sample of these borings is then tested for shrinkage.

Crimp.—Natural waviness of the wool fiber.

Cross bred.—In the United States a wool from a hybrid sheep. In Great Britain and the Dominions any wool that is not Merino.

Crutchings.—An Australasian term for pieces. Also applied to britch and udder locks shorn from bred ewes prior to lambing, and to britch wools which sometimes are shorn from flocks before they leave winter quarters for lush spring pastures.

Delaine wool.—Fine farm-flock wools originating in Ohio, Michigan, Pennsylvania, and West Virginia and of strictly combing lengths.

Domestic wool.—As used in this report, the term means wool grown in the United States as contrasted with foreign wool.

Elasticity.—Ability to return to former position or length after being stretched; due in large part to soundness and crimp, but adversely affected by ill-health of the sheep, its lack of feed, or deficiency of yolk in the growing fleece.

Felt.—Woven or matted and heavily fulled wool goods as distinct from woolen and worsteds. The term "felt" usually applies to material in which the wool fibers are held together by being matted or felted, without spinning or weaving.

Felting.—The property or characteristic of wool suitable for that purpose; also the process of matting or felting the fibers.

Filling.—Weaving yarns which lie crosswise in the cloth. Also applied to starching and weighting in the finishing of some types of cloth.

Fine (wool).—Wool from sheep with a large proportion of merino blood. Wool of small fiber diameter.

Fleece wool.—A term applied to wool produced mainly east of the Missouri and Mississippi Rivers, primarily by small farm flocks.

French combing.—Too short to comb on the English system but long enough to comb on a French comb.

Garnetting.—An operation whereby cloth rags or wastes are reduced to the fiber stage.

Grade (wool).—Relates primarily to fineness, or diameter, of the fibers.

Grading (wool).—Classifying of entire fleeces (without opening or breaking them) according to fineness and length of fiber and suitability for different mill needs.

Grease wool.—Wool as it comes from the sheep.

Half-blood (wool).—A grade of domestic wool obtained from sheep that are half merino blood; the equivalent of English 58s and 60s.

Handle.—A term used to denote how a yarn or fabric feels when touched, felt or handled, such as harsh, soft, smooth, resilient, limp, compact, and springy.

Hygroscopic.—The capacity to absorb (and to give up) moisture.

In bond.—Imported wool impounded by the Federal Government pending the payment of customs duties or tariff.

Jute.—The fiber obtained from the inner bark of a tall Asiatic herb, used for wool bags.

Laps.—The soft waste from worsted drawing and spinning.

Lines.—Lots of wool whose uniformity in color, luster, and other characteristics of value, merits being graded together.

Lofty (wool).—Open wool, full of "life." After being crushed in the hand, it springs back into normal position and is very elastic.

Low (wool).—Coarse wools, usually 46s or below.

Luster.—Brightness, sheen, or shine of yarns or fabrics.

Matchings (wool).—The different sorts of wool into which the fleece is divided in sorting.

Mending.—A process whereby flaws in worsteds or woolens are repaired.

Merino.—Wool of fine quality from the merino sheep.

Mohair.—A lustrous white hair obtained from the Angora goat.

Native wool.—In the United States this term properly refers to the domestic clip removed east of the Territory region, but is usually applied to the clip produced east of the Mississippi River. Wool from unimproved sheep kept in different parts of the world, and which produce carpet fiber, is often called native wool.

Noil, noils.—Short fibers removed in combing.

Noilage or tearage.—The proportion or percentage of noils combed from 100 pounds of scoured wool, allowance being made for vegetable matter, if any. When noils are relatively high priced, the combing is likely to be more severe and the noilage is higher, although usually at the expense of loftiness in the top.

Offs.—Undesirable fleeces that do not match the characteristics of the bulk of the clip—badly stained, dead, black, etc.

Offsorts.—The portions or sorts of a fleece that are less valuable than the main or regular sorts in the same fleece because of paint brands, stain, etc.

Perching.—A method of examining a woolen or worsted fabric for possible defects after weaving, as well as at various stages in finishing.

Pieces.—A wool-sorting term referring to wool staples gathered from various types of fleeces and sold in separate or mixed lots.

Pulled wool.—Removed from the pelts of slaughtered lambs and sheep.

Putting up wool.—The preparation of raw wool for marketing either in bags or in graded piles in the warehouse.

Quarter-blood wool.—Domestic wool of a certain degree of fineness ("bulk" American 50s).

Ram.—A flock sire, or male sheep, often referred to as a "buck."

Raw wool.—As it comes from the sheep.

Reeding.—Consists of drawing the wool through a series of splits in a comblike device that serves to distribute and hold the yarns evenly at a definite width known as reed width in the loom, to act as a back rest to the shuttle, and to beat the filling yarn into the woven cloth during weaving.

Resilience.—Essentially resistance to longitudinal pressure, a characteristic of most carpet wools.

Rigidity.—In the wool fiber, the property determining its resistance to twist.

Roving.—An attenuated strand of fibers, a product of the roving frame, from which yarn is spun.

Scourer.—A firm engaged in removing impurities from raw wool by chemical processes.

Scouring.—The washing process to which wool and fabrics are subjected in order to remove grease and dirt.

Seedy.—Containing excessive seed or chaff.

Shearing.—Removal of a fleece with shears; also applied to the removal of uneven, projecting fibers from the surface of woven or felted fabrics.

Shoddy.—Wool fiber recovered by means of "pickering" cuttings, clippings, and rags from all-wool knit goods and soft all-wool fabrics. In a general, less accurate, sense it is applied to all recovered wool fiber.

Shrinkage.—Percentage of the weight of grease wool lost in scouring.

Skirting.—Removal of belly, britch, neck, leg, and stained portions from the main part of the fleece and sometimes the backs. It is almost universally done in preparing Australasian wool for market and to a considerable extent is practiced in South Africa and South America.

Sorting.—Breaking up the individual fleeces into a number of quality lines, according to the uses to which the wool is to be put in the mill, and also according to the character or evenness of the fleece.

Stained (wool).—Colored from contact with manure, urine, or by bacterial action.

Staple.—Territory fine combing wool is always referred to as territory fine staple. Staple properly refers to the length of the fiber, but in a more restricted sense it is used for a lock of wool in the fleece.

Staple wools.—Those that more than meet the minimum length requirements for a combing wool.

Suint.—Dried perspiration present in raw wool.

Tags (wool).—Trade term for every description of broken wool locks, etc., sorted from the fleece or swept from the floor of the shearing pen.

Tar.—One of the offsorts; stained by paint brands used on sheep. All brands are classified as tar by the sorter whether or not the substance is real tar.

Territory wool.—Produced in certain Western States, largely those in the Rocky Mountain area. The term originated through the fact that most of these States were important for wool growing before they were admitted to Statehood.

Three-quarter-blood wool.—A term originally applied to wool from sheep with three-fourths of merino blood, but which is now practically obsolete, being replaced by the terms "fine" or "X" or 64s.

Three-eighths-blood wool.—A term designating a given degree of fineness in domestic wool (56/58s quality) between low half-blood and high quarter-blood. It originally was applied to wool from sheep with three-eighths of merino blood.

Top.—A continuous untwisted, loose, rope-like strand of wool made up largely of the longer fibers resulting from the combing process.

Topmaking wools.—Average combing and Big French wool of the finer grades.

Trap sorting.—A method of sorting raw wool which removes very little from the fleece apart from tags, low ends, and britch.

Vegetable matter.—Various kinds of bur (some of which, as mestiza or bur-clover seed pods and needle grass, must be removed by carbonization), straw, chaff, seed, etc.

Vicuna.—A fiber obtained from the inner fleece of the Vicuna—a small goat-like, undomesticated animal native to the high Andes region of South America.

Virgin wool.—Wool not previously used in the manufacture of fabrics. Properly speaking, wool wastes and noils are "virgin" wool fiber. Some authorities question whether hard wastes—those with twist, and which have to be garnetted, may properly be considered "virgin" fiber.

Warp.—The series of threads that run lengthwise in a fabric.

Weft.—English term for filling; the yarn running crosswise in a fabric.

Woolen.—Fabrics or yarn made of uncombed wool.

Woolens.—Fabrics for which the wool fibers are subjected to intermatting action in the card in the first stages of manufacture, in order to interlace or lay them in as many directions as possible, the better to hold together in yarn drawing, and to a certain extent the better to felt together in the finishing process. Comparatively short lengths of wool are used in making woolens as compared with worsteds, which are made on the opposite principle. Woolens, being felted, average much heavier than worsteds, but as a rule the fabric is weaker.

Wool grades.—The United States Department of Agriculture issued 12 standards for the following grades of wool, which are recognized by law, on June 18, 1926. A 13th (62s) was added in January 1940.

STANDARD U. S. WOOL AND TOP GRADES

Fine	80s 70s 64s	Quarter-blood	50s 48s
		Low-quarter blood	46s
Half-blood	62s 60s 58s	Common	44s
		Braid	40s 36s
Three-eighths blood	56s		

Wool waste.—Card, top, slubbing, roving, laps or spinners, brush, and ring waste; derived respectively from the card, comb, slubber, roving frame, in the drawing; and on the spinning frame during the process of manufacture. Ring waste is broken roving which becomes wound around the underclearers on the spinning frame. Noil, the short fibers combed out in top-making, is the principal and, because of the amount normally made, the most valuable wool waste.

Worsted.—Fabrics or yarn made of combed wool.

Worsteds.—Fabric for which the wool fibers are "combed" after being lightly "carded" to open them up, in order to remove short, weak, refractory material (noils) and to lay the remaining longer fibers as nearly parallel as possible, partly to prevent felting during subsequent working, but mainly to obtain the utmost possible uniformity in the diameter of the spun yarn or thread.

Yarn.—A continuous strand of any textile fiber made by pulling and twisting it simultaneously.

Yield.—The quantity of clean wool obtained from a specified amount of grease wool.

Yolk.—Fatty grease or oil deposited on the wool fibers from the oil glands, and very necessary for sound, well-grown fleeces of good character.

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