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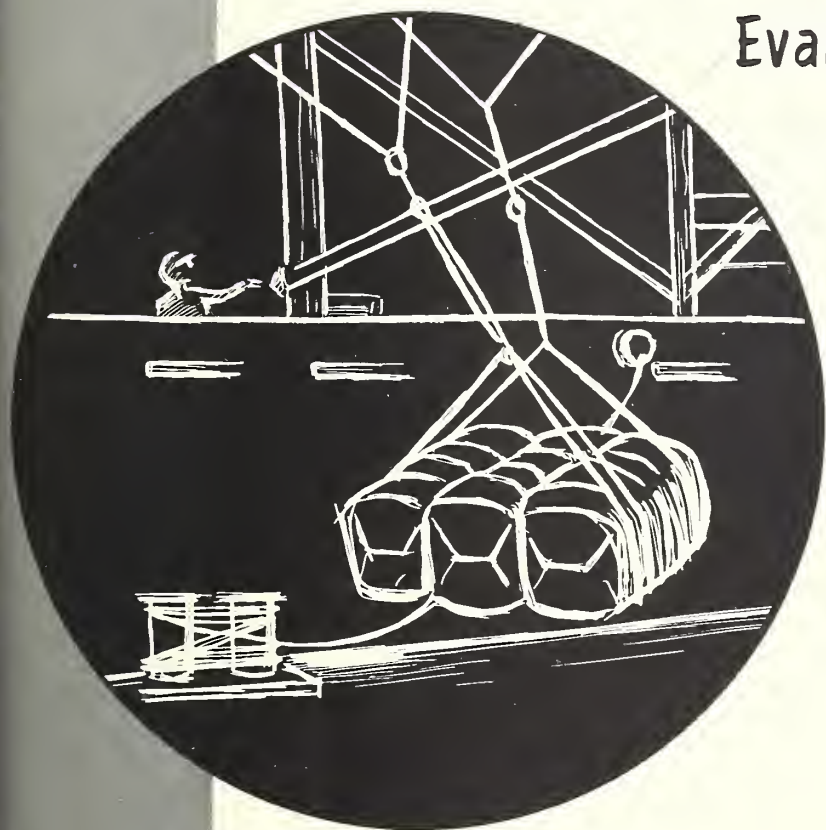
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Foreign and United States Upland Cotton

Quality Comparisons and
Evaluations, 1955 Crop



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FOREWORD

This report is the second in a project having as its objective the analysis and evaluation of the fiber and spinning properties of foreign cottons that compete with United States cotton in the markets of the world.

More information is needed in consuming centers on the basic fiber and spinning properties of foreign cottons which have come into commercial importance during recent years. From the merchandising standpoint, the need is pointed up by the many widely different grading systems used by cotton producing countries throughout the world and by the corresponding absence of common denominators for determining the ultimate value or spinning utility of cotton, regardless of the year or country of its growth.

Tests made on laboratory machines and instruments showing precise measurements of the several properties making up quality of raw cotton give a more uniform and a more comprehensive basis for determining the spinning utility of cotton than the conventional classing systems. Such test results, now included in many sales contracts, offer promise of providing the common denominators needed. The problem lies in the development of a system that is not only practical in the merchandising of cotton but also accounts for all of the important fiber and spinning properties rather than grade and staple length alone.

We believe the comparisons of fiber characteristics typical of different growths of cotton and the aggregate evaluations of quality by the method developed in this study will contribute to a better understanding of market preferences for one growth of cotton over others of similar commercial classification. The method may be used to compare and evaluate most classifications of upland type cotton. Fiber and spinning test comparisons of additional foreign cottons are under way.

R. C. Sherman
Director, Cotton Division

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SUMMARY

Foreign cotton consumers as well as domestic producers and exporters have long felt the need for basic information that could be used in making comprehensive comparisons of quality in United States cotton and in competing foreign growths. Such comparisons, to be of practical use, should take into account all of the important measurable properties of cotton quality, and evaluate each property in proportion to the contribution it makes to the overall spinning utility or market value of the cotton.

This report compares the fiber and spinning properties of United States upland cotton from the 1955 crop with those of four competing foreign growths and evaluates these properties by a practical method which can be used for establishing the superiority of one cotton over another. In most of the comparisons, the United States cotton had a higher overall quality index than the foreign growths. Its high rank in the overall quality rating resulted from a combination of desirable characteristics rather than from superiority in any one.

FOREIGN AND UNITED STATES UPLAND COTTON: QUALITY COMPARISONS AND EVALUATIONS 1955 CROP

By T. L. W. Bailey, Jr., Cotton Technologist, and R. T. Baggett, Agricultural Economist, Cotton Division, Foreign Agricultural Service

Under given levels of prices, stability of supply, and merchandising efficiency, United States cotton carries certain premiums over most foreign growths in world markets on the basis of relative spinning value. The United States cotton industry, however, must continue to prove this superiority in quality if our foreign markets for cotton are to be retained and expanded.

Most cotton manufacturers specialize to some degree in the qualities of raw cotton they purchase, and thus are interested primarily in evaluating different growths, types, or varieties of cotton having quality characteristics within well-defined limits. As a consequence, the properties of each marketable quality are subjected to some type of evaluation at some stage of the marketing and processing. During recent years, the measurement of quality in cotton by the use of machines and instruments on a commercial scale as a supplement to or refinement of manual classification has increased greatly and is incorporated in many sales contracts.

Fiber and spinning test results for cotton produced commercially in the United States by cotton improvement groups have been published regularly since 1946 by the Agricultural Marketing Service of the Department. These test results show measurements and interpretations of the numerous fiber and spinning properties of cotton associated with quality, listed separately by major varieties, areas of growth, and periods of harvest. Similar fiber and spinning test results have now become available on a limited scale for a number of foreign cottons that are in direct competition with the bulk of United States cotton which enters world trade.¹

In this report, fiber and spinning test comparisons are made of 12 qualities of United States cotton from the 1955 crop and 204 samples of identical grades and staple lengths from the 1955 crops of Brazil, Mexico, Pakistan, and Turkey. The method of comparison and evaluation involves indexes of the three property groups of grade, fiber, and manufacturing quality and a combined or overall quality index, starting with samples or lots of American and foreign cotton that are identical with respect to grade and staple length as classified under the Official Standards of the United States. The basis for the indexes is a hypothetical "superior" cotton, each quality element of which is assigned an index value of 100. Each growth and classification of cotton compared is then evaluated in terms of the superior cotton. Thus, the overall evaluation or quality index of a sample or lot of cotton is determined by the proportionate contributions of 11 of the more important measurable properties associated with cotton quality.

The 204 samples of foreign cotton, selected by commercial firms as being representative of the qualities exported, fell into 15 lots composed of 12 grade and staple length classifications when graded under the official standards and compounded into like classifications for tests and for comparisons with like qualities of United States cotton. Fiber and spinning test results of all United States cotton of these 12 classifications tested from the 1955 crop were averaged for comparison with the foreign cottons. Thus, 15 comparisons could be made of the test results and quality indexes of United States cotton with those for like classifications of foreign cotton.

¹ For comparisons of test results of American Egyptian and Egyptian cotton, see "Comparison of Some Fiber and Spinning Test Results of Egyptian and American Egyptian Cottons," Foreign Agriculture Circular FC 7-56, October 1956.

United States cotton had a higher overall quality index than the foreign growths of the same grade and staple length in 11 of the 15 comparisons. Of the 11 comparisons in which United States cotton excelled, 7 were in grades Middling and Strict Middling and 4 were in grades Strict Low and Low Middling. United States cotton had a higher quality index than the same grade and staple length of Mexican cotton in 3 of a total of 6 comparisons; it exceeded Pakistani cotton in 1 of 2 comparisons; Brazilian in each of 5 comparisons; and Turkish in each of 2 comparisons.

As expected, United States and Mexican cottons were found to be very similar. The test lots of Pakistani cotton were characterized by very strong fiber and yarn, but their overall quality indexes were reduced because of excessive nonlint content and manufacturing waste. The higher grades of Brazilian cotton included in the tests measured up well in grade properties, but all grades were deficient in manufacturing properties. The two classifications of Turkish cotton fell below the three growths with which they were compared in practically every quality characteristic.

The method used in making the fiber and spinning test comparisons and in developing the quality indexes is explained in the sections beginning on page 18. Similar quality indexes may be computed for most classifications of upland cotton by use of fiber and spinning test results which are now available commercially. In such a computation, alternative weighting factors may be used for the individual grade, fiber, and manufacturing properties.

COMPARISON OF TEST RESULTS AND QUALITY INDEXES

The property group and overall quality indexes for each grade and staple length of United States and foreign cotton for which comparisons were made are shown in tables 1 through 12. Also shown in these tables for each grade and fiber property are the weight factors assigned, the original test data, the degree of perfection index (measure of the property's value in terms of a hypothetical "superior" cotton), and the weighted quality points. The weighted quality points were obtained by multiplying the weight factor by the degree of perfection index. The weighted quality points were then divided by the sum of the weight factors to obtain the quality indexes.

An explanation of the procedure used in establishing values for the properties of the "superior" cotton for the sample lots tested and compared, and in the development of the quality indexes, is included in the sections beginning on page 18.

Strict Middling 15/16-Inch, United States and Brazilian

Comparisons of the fiber and spinning test results and quality indexes of United States upland cotton classed as Strict Middling 15/16-inch with Brazilian cotton of the same classification are shown in table 1.

The grade quality index of the Brazilian cotton was 98.7 compared with an index for the United States cotton of 96.6. The grade quality value of the Brazilian was higher than the United States cotton because of the very low nonlint content and the lesser amount of picker and card waste produced during manufacturing. The fiber quality index of the United States cotton was 85.2, compared with 86.0 for the Brazilian. The difference was accounted for largely by higher maturity and strength of the Brazilian fibers. The manufacturing quality index of the United States cotton was significantly higher at 67.3 than the Brazilian at 62.6, mostly because of fewer neps and considerably stronger yarn. The overall quality index of the United States cotton was 81.7, compared with a quality index of 80.9 for the Brazilian.

TABLE 1.--Comparison of fiber and spinning test results and quality indexes of Strict Middling 15/16-inch cotton, United States and Brazilian, crop of 1955

Properties measured	Weight factor ¹	Original test data ²		Degree of perfection ³		Weighted quality points ⁴	
		U. S.	Brazil	U. S.	Brazil	U. S.	Brazil
Grade groups:	<i>Percent</i>			<i>Index</i>	<i>Index</i>		
Classer's grade.....	5	SM	SM	98	98	490	490
Nonlint content (Shirley).....	9	2.2	2.0	99	100	891	900
Picker and card waste.....	11	7.8	7.0	94	98	1,034	1,078
Grade quality points.....	25	--	--	--	--	2,425	2,463
Grade quality index ⁵	--	--	--	96.6	98.7	--	--
Fiber group:							
Length, U.H.M., Fibrograph ...	5	91	90	73	72	365	360
Length, uniformity.....	5	80	81	91	92	455	460
Fineness, Micronaire.....	10	4.5	4.8	96	92	960	920
Maturity, Causticaire.....	4	79	82	90	93	360	372
Strength, zero gauge.....	15	75	80	79	84	1,185	1,260
Fiber quality points.....	39	--	--	--	--	3,325	3,372
Fiber quality index ⁵	--	--	--	85.2	86.0	--	--
Manufacturing group:							
Neps.....	3	9	3	96	100	288	300
Yarn break factor.....	30	2,214	2,008	63	57	1,890	1,710
Yarn appearance.....	3	107	105	82	81	246	243
Mfg. quality points.....	36	--	--	--	--	2,424	2,253
Mfg. quality index ⁵	--	--	--	67.3	62.6	--	--
Total quality points.....	100	--	--	--	--	8,174	8,093
Overall quality index ⁵	--	--	--	81.7	80.9	--	--

¹ Percentage value assigned each property.

² In various units of measurement.

³ "Superior" cotton = 100.

⁴ Weight factor assigned times degree of perfection index.

⁵ Total quality points divided by total of weight factors assigned.

Strict Middling 1-1/16 Inches, United States and Mexican

Tests and comparisons of these two lots, as shown in table 2, demonstrated little choice between American and Mexican cotton of this grade and staple length. The quality indexes of the Mexican were slightly higher than the United States cotton in each of the grade, fiber, and manufacturing groups. The Mexican lot produced slightly less processing waste, was slightly more uniform in fiber length, and produced somewhat stronger yarn than the United States lot. On the other hand, the United States lot produced slightly stronger fibers, some fewer neps, and yarn of a little better appearance. The overall quality index of the United States cotton was 85.3 compared with 87.2 for the Mexican, reflecting mostly the stronger yarn of the Mexican.

Strict Middling 1-3/32 Inches, United States and Mexican

Comparisons of fiber and spinning test results of United States and Mexican cotton classed as Strict Middling 1-3/32 inches, as set out in table 3, showed that the overall

TABLE 2.--Comparison of fiber and spinning test results and quality indexes of Strict Middling 1-1/16 inches cotton, United States and Mexico, crop of 1955

Properties measured	Weight factor ¹	Original test data ²		Degree of perfection ³		Weighted quality points ⁴	
		U. S.	Mexico	U. S.	Mexico	U. S.	Mexico
Grade group:	<i>Percent</i>			<i>Index</i>	<i>Index</i>		
Classer's grade.....	5	SM	SM	98	98	490	490
Nonlint content (Shirley)....	9	2.6	2.4	99	99	891	891
Picker and card waste.....	11	8.1	7.3	94	98	1,034	1,078
Grade quality points.....	25	--	--	--	--	2,415	2,459
Grade quality index ⁵	--	--	--	96.6	98.4	--	--
Fiber group:							
Length, U.H.M., Fibrograph ..	5	1.05	1.06	84	85	420	425
Length, uniformity.....	5	82	81	93	95	465	475
Fineness, Micronaire.....	10	4.3	4.4	98	100	980	1,000
Maturity, Causticaire.....	4	79	80	90	91	360	364
Strength, zero gauge.....	15	82	80	86	84	1,290	1,260
Fiber quality points.....	39	--	--	--	--	3,515	3,524
Fiber quality index ⁵	--	--	--	90.1	90.4	--	--
Manufacturing group:							
Neps.....	3	11	15	96	96	288	288
Yarn break factor.....	30	2,401	2,574	69	74	2,070	2,220
Yarn appearance.....	3	104	99	80	76	240	228
Mfg. quality points.....	36	--	--	--	--	2,598	2,736
Mfg. quality index ⁵	--	--	--	72.2	76.9	--	--
Total quality points.....	100	--	--	--	--	8,528	8,719
Overall quality index ⁵	--	--	--	85.3	87.2	--	--

¹ Percentage value assigned each property.

² In various units of measurement.

³ "Superior" cotton = 100.

⁴ Weight factor assigned times degree of perfection index.

⁵ Total quality points divided by total of weight factors assigned.

quality index of the United States cotton was somewhat higher than the Mexican, 85.8 and 84.0, respectively. In the grade group, the United States cotton had a quality index of 98.4 compared with 96.2 for the Mexican, due mostly to slightly higher processing waste in the Mexican. The somewhat higher fiber quality index of 88.3 for the American, compared with an index of 84.5 for the Mexican, resulted from stronger, finer, and more mature fibers, although the upper half mean length of the Mexican fibers in this group was nearly 1/32-inch longer than the United States lot. There was practically no choice between the two growths in manufacturing properties, the index for the Mexican being 0.7 point higher because of slightly stronger yarn produced.

Middling 1-1/32 Inches, United States, Pakistani, and Turkish

A comparison of the fiber and spinning test results of United States Middling 1-1/32 inches cotton and like grades and staple lengths from Pakistan and Turkey gave overall quality indexes of 83.0, 82.4, and 75.9, respectively, as shown in table 4. Comparing the individual property groups, the grade contribution to quality of the United States

TABLE 3.--Comparison of fiber and spinning test results and quality indexes of Strict Middling 1-3/32 inches cotton, United States and Mexico, crop of 1955

Properties measured	Weight factor ¹	Original test data ²		Degree of perfection ³		Weighted quality points ⁴	
		U. S.	Mexico	U. S.	Mexico	U. S.	Mexico
Grade group:	<i>Percent</i>			<i>Index</i>	<i>Index</i>		
Classer's grade.....	5	SM	SM	98	98	490	490
Nonlint content (Shirley)....	9	2.6	3.1	99	98	891	882
Picker-card waste.....	11	7.6	7.8	98	94	1,078	1,034
Grade quality points.....	25	--	--	--	--	2,459	2,406
Grade quality index ⁵	--	--	--	98.4	96.2	--	--
Fiber group:							
Length, U.H.M., Fibrograph ..	5	1.06	1.10	85	88	425	440
Length, uniformity.....	5	79	79	90	90	450	450
Fineness, Micronaire.....	10	4.1	3.7	93	84	930	840
Maturity, Causticaire.....	4	77	74	87	84	348	336
Strength, zero gauge.....	15	82	78	86	82	1,260	1,230
Fiber quality points.....	39	--	--	--	--	3,443	3,296
Fiber quality index ⁵	--	--	--	88.3	84.5	--	--
Manufacturing group:							
Neps.....	3	12	15	96	96	288	288
Yarn break factor.....	30	2,539	2,551	72	73	2,160	2,190
Yarn appearance.....	3	99	97	76	75	228	225
Mfg. quality points.....	36	--	--	--	--	2,676	2,703
Mfg. quality index ⁵	--	--	--	74.3	75.0	--	--
Total quality points.....	100	--	--	--	--	8,578	8,405
Overall quality index ⁵	--	--	--	85.8	84.0	--	--

¹ Percentage value assigned each property.

² In various units of measurement.

³ "Superior" cotton = 100.

⁴ Weight factor assigned times degrees of perfection index.

⁵ Total quality points divided by total of weight factors assigned.

cotton was very substantially higher than cotton from the other two countries. The United States cotton contained less than half the foreign material than the average of the other two and it produced significantly less picker and card waste during manufacturing. The Pakistani cotton had the highest index for fiber quality, due mainly to its very strong fiber, as well as to a higher maturity and uniformity rating. The quality index of the Turkish cotton was significantly lower than the United States cotton in the fiber category. In the manufacturing quality index, the Pakistani cotton had the highest rating because of yarn strength. The Turkish cotton had substantially lower index values than the Pakistani and American in all properties tested.

Middling Light Spotted, 1-1/32 Inches, United States and Brazilian

Comparisons of United States Middling Light Spotted 1-1/32 inches cotton and a like grade and staple length from Brazil are shown in table 5. The United States cotton earned higher quality indexes than the Brazilian cotton for each of the property groups as well as for the overall sample. In fact, the Brazilian lot excelled the American in only three

TABLE 4.--Comparison of fiber and spinning test results and quality indexes of Middling 1-1/32 inches cotton, United States, Pakistan, and Turkey, crop of 1955

Properties measured	Weight factor ¹	Original test data ²			Degree of perfection ³			Weighted quality points ⁴				
		U.S.		Turkey	U.S.		Pak.	Turkey	U.S.		Pak.	Turkey
		U.S.	Pak.	Turkey	Index	Index	Index	Index	U.S.	Pak.	Turkey	
Grade group:	Percent	M	M	M	Index	Index	Index	Index	U.S.	Pak.	Turkey	
Classer's grade.....	5				94	94	94	94	470	470	470	
Nonlint content (Shirley).....	9	2.7	6.5	6.3	98	80	80	80	882	720	720	
Picker-card waste.....	11	8.1	10.0	12.4	94	87	80	80	1,034	957	880	
Grade quality points.....	25	--	--	--	--	--	--	--	2,386	2,147	2,070	
Grade quality index ⁵	--	--	--	--	95.4	85.9	82.8	82.8	--	--	--	
Fiber group:												
Length, U.H.M., Fibrograph.....	5	1.02	.96	.94	82	77	75	75	410	385	375	
Length, uniformity.....	5	80	82	77	91	93	87	87	455	465	435	
Fineness, Micronaire.....	10	4.4	4.4	3.6	100	100	82	82	1,000	1,000	820	
Maturity, Causticaire.....	4	79	80	74	90	91	84	84	360	364	336	
Strength, zero gauge.....	15	78	87	77	82	92	81	81	1,230	1,380	1,215	
Fiber quality points.....	39	--	--	--	--	--	--	--	3,455	3,594	3,181	
Fiber quality index ⁵	--	--	--	--	88.5	92.2	81.6	81.6	--	--	--	
Manufacturing group:												
Neps.....	3	10	8	10	96	96	96	96	288	288	288	
Yarn break factor.....	30	2,250	2,311	2,152	64	66	61	61	1,920	1,980	1,830	
Yarn appearance.....	3	106	100	95	82	77	73	73	246	231	219	
Mfg. quality points.....	36	--	--	--	--	--	--	--	2,454	2,499	2,337	
Mfg. quality index ⁵	--	--	--	--	68.1	69.4	64.9	64.9	--	--	--	
Total quality points.....	100	--	--	--	--	--	--	--	8,295	8,240	7,588	
Overall quality index ⁵	--	--	--	--	83.0	82.4	75.9	75.9	--	--	--	

¹ Percentage value assigned each property.

² In various units of measurement.

³ "Superior" cotton = 100.

⁴ Weight factor assigned times degree of perfection index.

⁵ Total quality points divided by total of weight factors assigned.

TABLE 5.--Comparison of fiber and spinning test results and quality indexes of Middling Light Spotted 1-1/32 inches cotton, United States and Brazil, crop of 1955

Properties measured	Weight factor ¹	Original test data ²		Degree of perfection ³		Weighted quality points ⁴	
		U. S.	Brazil	U. S.	Brazil	U. S.	Brazil
Grade group:	<i>Percent</i>			<i>Index</i>	<i>Index</i>		
Classer's grade.....	5	M.ltsps	M.ltsps	91	91	455	455
Nonlint content (Shirley)...	9	3.4	5.6	91	87	819	783
Picker-card waste.....	11	9.1	10.4	91	87	1,001	957
Grade quality points.....	25	--	--	--	--	2,275	2,195
Grade quality index ⁵	--	--	--	91.0	87.8	--	--
Fiber group:							
Length, U.H.M., Fibrograph .	5	1.02	.98	82	78	410	390
Length, uniformity.....	5	81	78	92	88	460	440
Fineness, Micronaire.....	10	4.0	4.2	91	95	910	950
Maturity, Causticaire.....	4	76	78	86	89	344	356
Strength, zero gauge.....	15	84	72	88	76	1,320	1,140
Fiber quality points.....	39	--	--	--	--	3,444	3,276
Fiber quality index ⁵	--	--	--	88.3	84.0	--	--
Manufacturing group:							
Neps.....	3	19	16	83	83	249	249
Yarn break factor.....	30	2,217	2,041	63	58	1,890	1,740
Yarn appearance.....	3	95	100	73	77	219	231
Mfg. quality points.....	36	--	--	--	--	2,358	2,220
Mfg. quality index ⁵	--	--	--	65.5	61.7	--	--
Total quality points.....	100	--	--	--	--	8,077	7,691
Overall quality index ⁵	--	--	--	80.8	76.9	--	--

¹ Percentage value assigned each property.

² In various units of measurement.

³ "Superior" cotton = 100.

⁴ Weight factor assigned times degree of perfection index.

⁵ Total quality points divided by total of weight factors assigned.

properties, fineness and maturity of fibers and appearance of the yarn produced therefrom. In the grade group the quality indexes were 91.0 for United States and 87.8 for the Brazilian. In the fiber group the quality indexes were 88.3 and 84.0, respectively, and for the manufacturing quality group 65.5 and 61.7, respectively. The overall sample quality index of the United States cotton was 80.8 and for the Brazilian 76.9.

Middling 1-1/16 Inches, United States, Brazilian, and Mexican

The importance in terms of spinning value of certain raw cotton properties was demonstrated in the comparisons in table 6 of United States, Brazilian, and Mexican cotton grading Middling 1-1/16 inches. The Mexican lot earned the highest overall quality rating, 83.9, compared with 83.1 for American and 80.2 for Brazilian. The Mexican lot was equal or superior to the other growths in all important property values and was not significantly lower in any of the less important elements. On the other hand, the Brazilian lot had the highest values for the relatively unimportant properties of fiber maturity and yarn appearance, but was deficient in the five properties of nonlint content,

TABLE 6.---Comparison of fiber and spinning test results and quality indexes of Middling 1-1/16 inches cotton, United States, Brazil, and Mexico, crop of 1955

Properties measured	Weight factor ¹	Original test data ²			Degree of perfection ³			Weighted quality points ⁴				
		U. S.		Mexico	U. S.		Brazil	Mexico	U. S.		Brazil	Mexico
		M	3.1	M	Index	Index	Index	Index	Index	Index	Index	Index
Grade group:	Percent											
Classer's grade.....	5	M	M		94	94	94	470	470	470	470	470
Nonlint content (Shirley).....	9	3.1	3.4	3.0	98	94	98	882	882	846	882	882
Picker-card waste.....	11	8.1	8.7	8.4	94	87	94	1,034	1,034	957	1,034	1,034
Grade quality points.....	25	--	--	--	--	--	--	2,386	2,386	2,273	2,386	2,386
Grade quality index ⁵	--	--	--	--	95.4	90.9	95.4	--	--	--	--	--
Fiber group:												
Length, U.H.M., Fibrograph.....	5	1.05	.98	1.07	84	78	86	420	420	390	430	430
Length, uniformity.....	5	80	79	80	91	90	91	455	455	450	455	455
Fineness, Micronaire.....	10	4.2	4.3	4.3	95	98	98	950	950	980	980	980
Maturity, Causticaire.....	4	78	81	79	89	92	90	356	356	368	360	360
Strength, zero gauge.....	15	79	76	80	83	80	84	1,245	1,245	1,200	1,260	1,260
Fiber quality points.....	39	--	--	--	--	--	--	3,426	3,426	3,388	3,485	3,485
Fiber quality index ⁵	--	--	--	--	87.8	86.9	89.4	--	--	--	--	--
Manufacturing group:												
Neps.....	3	11	12	15	96	96	96	288	288	288	288	288
Yarn break factor.....	30	2,322	2,128	2,355	66	61	67	1,980	1,980	1,830	2,010	2,010
Yarn appearance.....	3	99	105	98	76	81	75	228	228	243	225	225
Mfg. quality points.....	36	--	--	--	--	--	--	2,496	2,496	2,361	2,523	2,523
Mfg. quality index ⁵	--	--	--	--	69.3	65.6	70.0	--	--	--	--	--
Total quality points.....	100	--	--	--	--	--	--	8,308	8,308	8,022	8,394	8,394
Overall quality index ⁵	--	--	--	--	83.1	80.2	83.9	--	--	--	--	--

1 Percentage value assigned each property.

2 In various units of measurement.

3 "Superior" cotton = 100.

4 Weight factor assigned times degree of perfection index.

5 Total quality points divided by total of weight factors assigned.

processing waste, fiber length, and strength of fiber and yarn, the aggregate value of which constitutes 70 per cent of the total. These comparisons also demonstrate the similarity of United States and Mexican cotton of this classification in practically all of the properties measured. These two growths differed in the property group indexes by no more than 1.6 points and in the overall quality index by only 0.8 point.

Middling 1-3/32 Inches, United States and Mexican

Comparisons of United States and Mexican Middling 1-3/32 inches cotton in table 7 show the quality index for the fiber properties group of United States cotton to be 89.1 and Mexican 84.6. The United States cotton was superior to the Mexican in fineness, maturity, and fiber strength. The index for the Mexican, on the other hand, was a little higher in the manufacturing group at 73.8, compared with 72.0 for the American cotton, due primarily to the substantially higher yarn break factor of the Mexican lot. Both cottons were high in the grade property index at 94.0. The overall quality index of the United States cotton was 84.2, compared with an index for the Mexican lot of 83.2. In the

TABLE 7.--Comparison of fiber and spinning test results and quality indexes of Middling 1-3/32 inches cotton, United States and Mexico, crop of 1955

Properties measured	Weight factor ¹	Original test data ²		Degree of perfection ³		Weighted quality points ⁴	
		U.S.	Mexico	U.S.	Mexico	U.S.	Mexico
Grade group:	<i>Percent</i>			<i>Index</i>	<i>Index</i>		
Classer's grade.....	5	M	M	94	94	470	470
Nonlint content (Shirley)...	9	3.2	3.3	94	94	846	846
Picker-card waste.....	11	7.9	8.0	94	94	1,034	1,034
Grade quality points.....	25	--	--	--	--	2,350	2,350
Grade quality index ⁵	--	--	--	94.0	94.0	--	--
Fiber group:							
Length, U.H.M., Fibrograph..	5	1.07	1.11	86	89	430	445
Length, uniformity.....	5	79	79	90	90	450	450
Fineness, Micronaire.....	10	4.2	3.7	95	84	950	840
Maturity, Causticaire.....	4	78	74	89	84	356	336
Strength, zero gauge.....	15	82	78	86	82	1,290	1,230
Fiber quality points.....	39	--	--	--	--	3,476	3,301
Fiber quality index ⁵	--	--	--	89.1	84.6	--	--
Manufacturing group:							
Neps.....	3	12	17	96	83	288	249
Yarn break factor.....	30	2,398	2,558	69	73	2,070	2,190
Yarn appearance.....	3	101	95	78	73	234	219
Mfg. quality points.....	36	--	--	--	--	2,592	2,658
Mfg. quality index ⁵	--	--	--	72.0	73.8	--	--
Total quality points.....	100	--	--	--	--	8,418	8,319
Overall quality index ⁵	--	--	--	84.2	83.2	--	--

¹ Percentage value assigned each property.

² In various units of measurement.

³ "Superior" cotton = 100.

⁴ Weight factor assigned times degree of perfection index.

⁵ Total quality points divided by total of weight factors assigned.

overall rating, higher index values earned by the Mexican cotton in the upper half mean length of fiber and in yarn strength were offset by higher values for fiber fineness, maturity, and strength; for neps count; and for yarn appearance in the United States lot.

Middling 1-5/32 Inches, United States and Turkish

Comparisons of Middling 1-5/32 inches American and Turkish cottons, table 8, showed that the American earned significantly higher quality index values for all three categories than the Turkish cotton. The outstanding differences were that the United States cotton contained less nonlint in the raw stock, had substantially less picker and card waste, produced significantly stronger fiber, and processed into much stronger yarn than the Turkish cotton. The overall quality index of the United States cotton was 86.2, compared with 78.8 for the Turkish. Although the Turkish cotton earned higher index values for length uniformity, fineness and maturity of fibers, and neppiness of yarn, the aggregate value assigned to these properties in the weighting system was only 22 percent of the total.

TABLE 8.--Comparison of fiber and spinning test results and quality indexes of Middling 1-5/32 inches cotton, United States and Turkey, crop of 1955

Properties measured	Weight factor ¹	Original test data ²		Degree of perfection ³		Weighted quality points ⁴	
		U. S.	Turk.	U. S.	Turk.	U. S.	Turk.
Grade group:	<i>Percent</i>			<i>Index</i>	<i>Index</i>		
Classer's grade.....	5	M	M	94	94	470	470
Nonlint content (Shirley)....	9	3.1	5.6	98	87	882	783
Picker-card waste.....	11	8.2	12.0	94	80	1,034	880
Grade quality points.....	25	--	--	--	--	2,386	2,133
Grade quality index ⁵	--	--	--	95.4	85.3	--	--
Fiber group:							
Length, U.H.M., Fibrograph...	5	1.16	1.14	93	91	465	455
Length, uniformity.....	5	80	81	91	92	455	460
Fineness, Micronaire.....	10	3.7	3.9	84	89	840	890
Maturity, Causticaire.....	4	76	80	86	91	344	364
Strength, zero gauge.....	15	81	68	85	72	1,275	1,080
Fiber quality points.....	39	--	--	--	--	3,379	3,249
Fiber quality index ⁵	--	--	--	86.6	83.3	--	--
Manufacturing group:							
Neps.....	3	15	2	96	100	288	300
Yarn break factor.....	30	2,728	2,294	78	66	2,340	1,980
Yarn appearance.....	3	96	95	74	73	222	219
Mfg. quality points.....	36	--	--	--	--	2,850	2,499
Mfg. quality index ⁵	--	--	--	79.2	69.4	--	--
Total quality points.....	100	--	--	--	--	8,615	7,881
Overall quality index ⁵	--	--	--	86.2	78.8	--	--

¹ Percentage value assigned each property.

² In various units of measurement.

³ "Superior" cotton = 100.

⁴ Weight factor assigned times degree of perfection index.

⁵ Total quality points divided by total weight factors assigned.

Strict Low Middling 1 Inch, United States and Brazilian

Comparison in table 9 of cotton produced in the United States and Brazil and grading Strict Low Middling 1 inch showed the American cotton to be superior in all important properties, receiving an overall quality index rating of 79.2, compared with 71.5 for the Brazilian. This superiority was evident in each property group, but was most pronounced in the manufacturing group, the indexes here being 63.8 for the United States cotton and 55.8 for the Brazilian. The United States cotton in this test lot showed 53 percent less foreign material in the raw stock and 26 percent less processing waste. At the same time, its fiber fineness was rated 10 percent higher than Brazilian and its fiber and yarn strength exceeded Brazilian by 13 and 19 percent, respectively.

TABLE 9.--Comparison of fiber and spinning test results and quality indexes of Strict Low Middling 1 inch cotton, United States and Brazil, crop of 1955

Properties measured	Weight factor ¹	Original test data ²		Degree of perfection ³		Weighted quality points ⁴	
		U. S.	Brazil	U. S.	Brazil	U. S.	Brazil
Grade group:	<i>Percent</i>			<i>Index</i>	<i>Index</i>		
Classer's grade.....	5	SIM	SIM	87	87	435	435
Nonlint content (Shirley)...	9	3.5	7.4	94	80	846	720
Picker-card waste.....	11	8.9	12.1	87	80	957	880
Grade quality points.....	25	--	--	--	--	2,238	2,035
Grade quality index ⁵	--	--	--	89.5	81.4	--	--
Fiber group:							
Length, U.H.M., Fibrograph..	5	.99	.90	79	72	395	360
Length, uniformity.....	5	79	79	90	90	450	450
Fineness, Micronaire.....	10	4.3	3.9	98	89	980	890
Maturity, Causticaire.....	4	78	75	89	85	356	340
Strength, zero gauge.....	15	76	67	80	71	1,200	1,065
Fiber quality points.....	39	--	--	--	--	3,381	3,105
Fiber quality index ⁵	--	--	--	86.7	79.6	--	--
Manufacturing group:							
Neps.....	3	10	9	96	96	288	288
Yarn break factor.....	30	2,074	1,743	59	50	1,770	1,500
Yarn appearance.....	3	104	95	80	73	240	219
Mfg. quality points.....	36	--	--	--	--	2,298	2,007
Mfg. quality index ⁵	--	--	--	63.8	55.8	--	--
Total quality points.....	100	--	--	--	--	7,917	7,147
Overall quality index ⁵	--	--	--	79.2	71.5	--	--

¹ Percentage value assigned each property.

² In various units of measurement.

³ "Superior" cotton = 100.

⁴ Weight factor assigned times degree of perfection index.

⁵ Total quality points divided by total of weight factors assigned.

Strict Low Middling 1-1/32 Inches, United States, Mexican, and Pakistani

In the lots grading Strict Low Middling 1-1/32 inches, compared in table 10, the overall quality index of Pakistani cotton was higher than that of Mexican or United States

TABLE 10.--Comparison of fiber and spinning test results and quality indexes of Strict Low Middling 1-1/32 inches cotton, United States, Mexico, and Pakistan, crop of 1955

Properties measured	Weight factor ¹		Original test data ²				Degree of perfection ³			Weighted quality points ⁴		
	Percent		U. S.	Mexico	Pak.	U. S.	Mexico	Pak.	U. S.	Mexico	Pak.	
						Index	Index	Index				
Grade group:												
Classer's grade.....	5	SIM	SIM	SIM	SIM	87	87	87	435	435	435	435
Nonlint content(Shirley).....	9	3.6	4.2	7.8	80	94	94	80	846	846	846	720
Picker-card waste.....	11	8.5	9.7	10.9	80	94	87	80	1,034	957	880	880
Grade quality points.....	25	--	--	--	--	--	--	--	2,315	2,238	2,035	2,035
Grade quality index ⁵	--	--	--	--	--	92.6	89.5	81.4	--	--	--	--
Fiber group:												
Length, U.H.M., Fibrograph.....	5	1.02	1.02	1.00	80	82	82	80	410	410	410	400
Length, uniformity.....	5	80	80	82	93	91	91	93	455	455	455	465
Fineness, Micronaire.....	10	4.2	4.3	5.0	88	95	98	88	950	980	880	880
Maturity, Causticaire.....	4	78	79	85	97	89	90	97	356	360	388	388
Strength, zero gauge.....	15	77	76	95	100	81	80	100	1,215	1,200	1,500	1,500
Fiber quality points.....	39	--	--	--	--	--	--	--	3,386	3,405	3,633	3,633
Fiber quality index ⁵	--	--	--	--	--	86.8	87.3	93.2	--	--	--	--
Manufacturing group:												
Neps.....	3	12	16	11	96	96	83	96	288	243	288	288
Yarn break factor.....	30	2,185	2,136	2,370	62	62	61	68	1,860	1,830	2,040	2,040
Yarn appearance.....	3	104	98	105	80	80	75	81	240	225	243	243
Mfg. quality points.....	36	--	--	--	--	--	--	--	2,388	2,304	2,571	2,571
Mfg. quality index ⁵	--	--	--	--	--	66.3	64.0	71.2	--	--	--	--
Total quality points.....	100	--	--	--	--	--	--	--	8,089	7,947	8,209	8,209
Overall quality index ⁵	--	--	--	--	--	80.9	79.5	82.1	--	--	--	--

1 Percentage value assigned each property.

2 In various units of measurement.

3 "Superior" cotton = 100.

4 Weight factor assigned times degree of perfection index.

5 Total quality points divided by total of weight factors assigned.

cotton of like classification, owing mostly to extremely strong fiber and yarn. Had it not had very high nonlint content and picker and card waste, the Pakistani lot of cotton would have earned a considerably higher overall index value. However, this wastage, totaling nearly 19 percent by weight, reflects the additional cost of processing the raw cotton and reduces the processing efficiency. These comparisons are considered highly significant from the standpoint of demonstrating how, within a given commercial classification, one growth of cotton may possess certain very outstanding features, such as extreme fiber strength in the case of the Pakistani lot, yet have lower overall value or spinning utility because of deficiencies in other properties. Although the fiber and yarn of this Pakistani lot of cotton were stronger than the United States cotton by 23 percent and 8 percent, respectively, the overall value of the Pakistani cotton under the evaluation system developed in this report was only 1.2 index points higher than the United States cotton.

Strict Low Middling 1-1/16 Inches, United States and Mexican

The quality index for Mexican Strict Low Middling 1-1/16 inches was higher in each property group than that for the equivalent United States cotton, owing to the lower proportion of picker and card waste, to longer, finer, and more mature fibers, and to stronger yarns produced. The overall quality index for Mexican was 82.8 and for United States 79.5, as shown in table 11. The Mexican cotton in this lot was of optimum fineness. Compared with the United States lot, it also had slightly longer staple and higher values for length uniformity and fiber maturity, which may have contributed to its smaller waste percentage and stronger yarn.

Low Middling 31/32-Inch, United States and Brazilian

The superiority of United States cotton in this classification, with an overall quality index of 77.4 against an index of 70.2 for the Brazilian, resulted from higher ratings in all individual properties measured except fiber strength and nep count, as shown in table 12. In the grade group, the quality index for Brazilian was 12 points below United States cotton because of nonlint content and picker and card waste aggregating almost 29 percent, compared with 16 percent for United States cotton. Very high fiber strength in the Brazilian was offset by shorter fiber length, coarseness, lower fiber uniformity and maturity, and substantially weaker yarn. This comparison demonstrates the importance of recognizing the contribution of a number of fiber properties and characteristics in the overall evaluation of quality in cotton.

COMPARISONS OF NONLINT CONTENT AND PICKER AND CARD WASTE

Tests of cotton used for preparation of the upland white grade standards show that each grade on the average contains a designated proportion of foreign material (leaf, trash, dirt) by weight, as determined by the Shirley Analyzer. These average nonlint or foreign material percentages for specified grades are shown in table 13. Also shown in the table for comparison are average nonlint percentages for specified grades of the 1955 crop of United States Upland cotton and for the equivalent grades of the foreign cottons tested.

The average nonlint content of the test lots of United States cotton from the 1955 crop included in this report was lower than the long-term average for each grade. The Mexican lots tested showed slightly higher nonlint content than the 1955 domestic crop, although lower than the long-term average. The Brazilian, Pakistani, and Turkish lots included in the comparisons contained larger percentages of nonlint or foreign material than the long-term average, except for Brazilian Strict Middling and Middling. Strict Low Middling Brazilian was Low Middling in nonlint content. The Turkish cotton, which graded Middling, was Low Middling in nonlint content. The average nonlint content of Pakistani cotton grading Middling and Strict Low Middling was equivalent to Low Middling.

TABLE 11.--Comparison of fiber and spinning test results and quality indexes of Strict Low Middling 1-1/16 inches cotton, United States and Mexico, crop of 1955

Properties measured	Weight factor ¹	Original test data ²		Degree of perfection ³		Weighted quality points ⁴	
		U. S.	Mexico	U. S.	Mexico	U. S.	Mexico
Grade group:	<i>Percent</i>			<i>Index</i>	<i>Index</i>		
Classer's grade.....	5	SIM	SIM	87	87	435	435
Nonlint content (Shirley)....	9	3.8	3.8	94	94	846	846
Picker-card waste.....	11	9.0	8.5	87	94	957	1,034
Grade quality points.....	25	--	--	--	--	2,238	2,315
Grade quality index ⁵	--	--	--	89.5	92.6	--	--
Fiber group:							
Length, U.H.M., Fibrograph...	5	1.05	1.08	84	86	420	430
Length, uniformity.....	5	78	81	88	92	440	460
Fineness, Micronaire.....	10	4.0	4.4	91	100	910	1,000
Maturity, Causticaire.....	4	76	78	86	89	344	356
Strength, zero gauge.....	15	77	77	81	81	1,215	1,215
Fiber quality points.....	39	--	--	--	--	3,329	3,461
Fiber quality index ⁵	--	--	--	85.4	88.7	--	--
Manufacturing group:							
Neps.....	3	12	12	96	96	288	288
Yarn break factor.....	30	2,177	2,317	62	66	1,860	1,980
Yarn appearance.....	3	101	100	78	77	234	231
Mfg. quality points.....	36	--	--	--	--	2,382	2,499
Mfg. quality index ⁵	--	--	--	66.1	69.4	--	--
Total quality points.....	100	--	--	--	--	7,949	8,275
Overall quality index ⁵	--	--	--	79.5	82.8	--	--

¹ Percentage value assigned each property.

² In various units of measurement.

³ "Superior" cotton = 100.

⁴ Weight factor assigned times degree of perfection index.

⁵ Total quality points divided by total of weight factors assigned.

Comparisons of the average picker and card waste percentages of the same lots of United States cotton with foreign cottons are shown in table 14. Except for the Brazilian lots grading Strict Middling, the Brazilian, Pakistani, and Turkish cottons produced picker and card waste equivalent to that found in United States cotton 1 to 2 grades lower. For example, the Middling Turkish cotton produced picker and card waste equivalent to Low Middling, and Low Middling from Brazil produced picker and card waste in amounts expected in Strict Good Ordinary United States cotton.

These data point up the superiority of all tested grades of United States cotton over comparable grades of cotton from Pakistan and Turkey and over the lower grades of Brazilian cotton in foreign material content and processing waste. The similarity of Mexican and United States cotton in these characteristics was also demonstrated. The nonlint content figures represent the percentage by weight of foreign material contained in the cotton. Although these percentages do not take into consideration the nature of the foreign material, which is important in consideration of grade, they do represent the

TABLE 12.--Comparison of fiber and spinning test results and quality indexes of Low Middling 31/32-inch cotton, United States and Brazil, crop of 1955

Properties measured	Weight factor ¹	Original test data ²		Degree of perfection ³		Weighted quality points ⁴	
		U. S.	Brazil	U. S.	Brazil	U. S.	Brazil
Grade group:	<i>Percent</i>			<i>Index</i>	<i>Index</i>		
Classer's grade.....	5	LM	LM	80	80	400	400
Nonlint content (Shirley)...	9	5.4	11.9	87	72	783	648
Picker-card waste.....	11	10.6	16.9	87	72	957	792
Grade quality points.....	25	--	--	--	--	2,140	1,840
Grade quality index ⁵	--	--	--	85.6	73.6	--	--
Fiber group:							
Length, U.H.M., Fibrograph..	5	.96	.86	77	69	385	345
Length, uniformity.....	5	81	73	92	83	460	415
Fineness, Micronaire.....	10	4.2	3.4	95	77	950	770
Maturity, Causticaire.....	4	79	73	90	83	360	332
Strength, zero gauge.....	15	79	87	83	92	1,245	1,380
Fiber quality points.....	39	--	--	--	--	3,400	3,242
Fiber quality index ⁵	--	--	--	87.2	83.1	--	--
Manufacturing group:							
Neps.....	3	19	22	83	83	249	249
Yarn break factor.....	30	1,997	1,740	57	50	1,710	1,500
Yarn appearance.....	3	105	80	81	62	243	186
Mfg. quality points.....	36	--	--	--	--	2,202	1,935
Mfg. quality index ⁵	--	--	--	61.2	53.8	--	--
Total quality points.....	100	--	--	--	--	7,742	7,017
Overall quality index ⁵	--	--	--	77.4	70.2	--	--

¹ Percentage value assigned each property.

² In various units of measurement.

³ "Superior" cotton = 100.

⁴ Weight factor assigned times degree of perfection index.

⁵ Total quality points divided by total of weight factors assigned.

Table 13.--Comparison of the nonlint content of United States and foreign cottons tested, with the long-term United States average

Grade	U.S. long-term ave. nonlint content ¹	Average nonlint content of 1955-crop lots tested				
		U.S.	Brazil	Mexico	Pakistan	Turkey
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
SM.....	2.9	2.5	2.0	2.8	--	--
M.....	3.7	3.0	3.4	3.2	6.5	6.0
SLM.....	5.1	3.6	7.4	4.0	7.8	--
LM.....	7.6	5.4	11.9	--	--	--

¹ Based on tests made on bales used in the white grade standards for upland cotton.

Table 14.--Comparison with the standard of the average picker and card waste of United States Upland and the foreign cottons tested

Grade	U.S. stand-ard picker and card waste ¹	Picker and card waste of 1955-crop lots tested				
		U.S.	Brazil	Mexico	Pakistan	Turkey
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
SM.....	7.2	7.8	7.0	7.6	--	--
M.....	8.1	8.1	8.7	8.2	10.0	12.2
SLM.....	9.3	8.8	12.1	9.1	10.9	--
LM.....	12.5	10.6	16.9	--	--	--

¹ Based on tests made on bales used in the white grade standards for upland cotton.

amount of trash, sand, or other foreign matter not detectable by the classer in proportions sufficient to justify giving the cotton a lower grade.

PROPERTY GROUP AND OVERALL COMPARISONS

Comparisons of the property group indexes and the overall quality indexes or aggregate evaluations of each grade and staple length of cotton tested are shown in table 15.

Grade Property Quality Indexes

With respect to the grade property group, the indexes for United States cotton were equal to or higher than those for equivalent classifications of foreign cottons in 12 of the 15 comparisons made. United States and Mexican cotton were about equal in grade indexes, as shown by 6 comparisons. The grade index of Brazilian was higher than United States cotton in the grade of Strict Middling 15/16-inch, but was substantially lower than United States in the other 4 comparisons made. In 4 comparisons, the grade property indexes for Pakistani and Turkish cottons were very substantially below United States cotton of comparable classification. Although in each of the comparisons the grade of the domestic and foreign cottons (as determined under the official standards) was the same, the grade property indexes of the foreign cottons in almost all of the comparisons were reduced because of the higher nonlint content and processing waste. This was particularly true for the Pakistani and Turkish cottons. In fact, the lower grade indexes were responsible for lower overall quality indexes for most of the foreign cottons.

In 2 of the 3 cases in which foreign growths earned a grade property index above United States cotton, the grades were Strict Middling. On the other hand, in only 3 of the 12 comparisons in grades Middling and below did the foreign cottons equal or excel United States cotton in grade properties. To the extent that the sample lots were representative of the domestic and foreign crops, this indicates that in the property elements making up grade, United States cotton excels these competitive growths in the middle and lower grades.

Fiber Property Quality Indexes

The superiority of United States cotton over the four foreign growths with which it was compared was not as evident in fiber properties as in grade. The fiber property indexes of both lots of Pakistani cotton were higher than the index of any other growth or

TABLE 15.--Summary comparison of quality indexes for grade, fiber, and manufacturing property groups and for the overall sample of all grades and staple lengths tested

Grade and staple length	Grade contribution					Fiber contribution				
	U.S.	Brazil	Mex.	Pak.	Turkey	U.S.	Brazil	Mex.	Pak.	Turkey
Strict Middling 15/16-inch.....	96.6	98.7	--	--	--	85.2	86.0	--	--	--
Strict Middling 1-1/16 inches.....	96.6	--	98.4	--	--	90.1	--	90.4	--	--
Strict Middling 1-3/32 inches.....	98.4	--	96.2	--	--	88.3	--	84.5	--	--
Middling 1-1/32 inches.....	95.4	--	--	85.9	82.8	88.5	--	--	92.2	81.6
Middling 1-1/16 inches.....	95.4	90.9	95.4	--	--	87.8	86.4	89.4	--	--
Middling 1-3/32 inches.....	94.0	--	94.0	--	--	89.1	--	84.6	--	--
Middling 1-5/32 inches.....	95.4	--	--	--	85.3	86.6	--	--	--	83.3
Strict Low Middling 1 inch.....	89.5	81.4	--	--	--	86.7	79.6	--	--	--
Strict Low Middling 1-1/32 inches.....	92.6	--	89.5	81.4	--	86.8	--	87.3	93.2	--
Strict Low Middling 1-1/16 inches.....	89.5	--	92.6	--	--	85.4	--	88.7	--	--
Low Middling 31/32-inch.....	85.6	73.6	--	--	--	87.2	83.1	--	--	--
Middling Light Spot 1-1/32 inches.....	¹ 91.0	87.8	--	--	--	¹ 88.3	84.0	--	--	--
	Manufacturing contribution					Overall sample				
	U.S.	Brazil	Mex.	Pak.	Turkey	U.S.	Brazil	Mex.	Pak.	Turkey
Strict Middling 15/16-inch.....	67.3	62.6	--	--	--	81.7	80.9	--	--	--
Strict Middling 1-1/16 inches.....	72.2	--	76.9	--	--	85.3	--	87.2	--	--
Strict Middling 1-3/32 inches.....	74.3	--	75.0	--	--	85.8	--	84.0	--	--
Middling 1-1/32 inches.....	68.1	--	--	69.4	64.9	83.0	--	--	82.4	75.9
Middling 1-1/16 inches.....	69.3	65.6	70.0	--	--	83.1	80.2	83.9	--	--
Middling 1-3/32 inches.....	72.0	--	73.8	--	--	84.2	--	83.2	--	--
Middling 1-5/32 inches.....	79.2	--	--	--	69.4	86.2	--	--	--	78.8
Strict Low Middling 1 inch.....	63.8	55.8	--	--	--	79.2	71.5	--	--	--
Strict Low Middling 1-1/32 inches.....	66.3	--	64.0	71.2	--	80.9	--	79.5	82.1	--
Strict Low Middling 1-1/16 inches.....	66.1	--	69.4	--	--	79.5	--	82.8	--	--
Low Middling 31/32-inch.....	61.2	53.8	--	--	--	77.4	70.2	--	--	--
Middling Light Spot 1-1/32 inches	¹ 65.5	61.7	--	--	--	¹ 80.8	76.9	--	--	--

¹ 1956 crop.

classification tested, and were substantially above the indexes of other growths of like grade and staple length. United States cotton was equal or superior to the foreign cottons of equivalent grade and staple length in fiber property indexes in 8 of the 15 comparisons, being excelled in these characteristics by Mexican in 4 of the 6 comparisons and by Brazilian in 1 of 5 comparisons, and substantially exceeded by Pakistani cotton in each of 2 comparisons. The outstanding feature of the Pakistani cottons tested was the strength and uniformity of the fibers.

Manufacturing Property Quality Indexes

In the contribution to overall quality of the manufacturing properties, the index value of United States cotton was higher than that of comparable qualities of each foreign cotton in 8 of the 15 comparisons. The manufacturing index value of Mexican cotton exceeded that of United States cotton in 5 of the 6 comparisons made. Likewise, the index values of the two Pakistani classifications were higher than those for the same grades of United States cotton. Stated another way, the manufacturing property indexes of both Mexican and Pakistani cottons were equal to or higher than the index for United States cotton in 7 of the 8 comparisons. This superiority, especially in the case of Pakistani cotton, was due in substantial part to yarn strength resulting from strength of individual fibers. The manufacturing property indexes for Brazilian and Turkish cottons were significantly lower than those for United States cotton in each of the 7 comparisons made.

Overall Sample Quality Indexes

As stated previously, this index reflects the overall or aggregate quality or desirability of given classifications of cotton. It is made up of the contribution to overall quality of each of the 11 properties measured, each property having been given a weight commensurate with its contribution to what might be termed spinning utility of the cotton. The significance of the index is the fact that it shows that a given bale or lot of raw cotton must have properties or characteristics in combination in order to meet spinning requirements in the manufacture of yarn or fabric for a specific product or group of products.

The value of an overall quality rating is pointed up by the fact that in the case of the Pakistani cotton tested, the highly desirable characteristics of extremely strong and very uniform fibers were depreciated by a comparatively high proportion of foreign material in the lint and by a high manufacturing waste percentage. These characteristics are not subject to full identification and evaluation in the manual classification of cotton. On the other hand, United States cotton, which was found to possess few individual characteristics as superior as fiber strength in the Pakistani cotton, nevertheless rated higher than the foreign growths in the overall quality index in 11 of the total of 15 comparisons made. In 7 of the 11 comparisons in which the overall quality index of United States cotton was higher than the index of the same grades and staple lengths of foreign cotton, the grades compared were Middling and above. Of the 4 comparisons in which the overall quality index of foreign cottons exceeded the index of United States cotton, 3 were Mexican (Strict Middling, Middling, and Strict Low Middling) and 1 was Pakistani (Strict Low Middling).

SELECTION AND CLASSIFICATION OF TEST LOTS

Through the cooperation of American cotton firms, 204 samples of 34 lots of 1955-crop upland cotton from Mexico, Brazil, Pakistan, and Turkey were supplied for fiber and spinning tests. The cooperating firms were requested to supply samples of designated grades and staple lengths as classified under the official standards from each of the countries. An effort was made to select samples most representative of the grades and staple lengths produced in quantity in each country and exported in direct competition with United States cotton. One-pound samples were drawn from each of six bales of identical grade and staple length. Fiber tests were made of each one-pound sample and the

results averaged. The six one-pound samples were then combined into one lot for the spinning test.

All of the cotton was classified under the Official Cotton Standards of the United States for the Grade of American Upland Cotton. The classing of the foreign samples was performed under code by a committee of cotton classers of the Cotton Division, Agricultural Marketing Service. The grade and staple length distribution of the domestic and foreign cottons for which test results were compared is shown in table 16.

TABLE 16.--Grade and staple length distribution of United States and foreign cotton for which test results were compared, crop of 1955¹

Grade	Staple length (inches)							Total
	15/16	31/32	1	1-1/32	1-1/16	1-3/32	1-5/32	
SM.....	1(1)	--	1(1)	--	14(5)	13(3)	8(1)	37(11)
M.....	--	--	7(1)	25(3)	62(8)	15(2)	6(1)	115(15)
SLM.....	--	--	6(1)	28(3)	54(3)	--	--	88(7)
LM.....	--	1(1)	--	--	--	--	--	1(1)
Total...	1(1)	1(1)	14(3)	53(6)	130(16)	28(5)	14(2)	241(34)

¹ Classed according to U. S. official standards for grade and staple length. Figures in parentheses are number and classification of foreign lots tested.

The United States cotton used for comparison with the foreign growths was selected from the 1955 crop by the Cotton Division, Agricultural Marketing Service, in connection with the annual survey of the fiber and spinning test results of the principal varieties of cotton produced commercially throughout the Cotton Belt.¹ The United States cotton tested and reported in Bulletin 152 included samples of 19 varieties from over 115 locations, representing early, middle, and late season harvestings. From these data, an average of the test results for each grade and staple length for which foreign samples were available was computed for comparison with a like quality of the foreign cotton.

The range in grade of the six lots from South Brazil was from Strict Middling to Low Middling, inclusive, and staple length from 15/16-inch to 1-1/16 inches, inclusive. The Mexican cotton included samples from three areas, Matamoros, Mexicali, and Sonora, with grades from Strict Middling to Strict Low Middling, inclusive, and staple lengths from 1 inch to 1-3/32 inches, inclusive.

The four lots from Pakistan included samples from two qualities, Sind-American and Punjab American, classed as Middling 1-1/32 inches and Strict Low Middling 1-1/32 inches. The four lots from Turkey were from Adana and Izmir with grades of Strict Middling and Middling and staple lengths of 1-1/32 inches and 1-5/32 inches.

The fiber and spinning tests were performed under a standard technique developed in the laboratories of the Cotton Division, Agricultural Marketing Service, for testing small samples. Each test lot was passed through standard-type textile machines. The processing procedure used by that agency conforms as nearly as possible with commercial mill practices. The tests for both the domestic and foreign cottons were identical with respect to technicians, methods, and machines or instruments. The test procedures were described in Bulletin No. 152.

¹U. S. Department of Agriculture, Agricultural Marketing Service. Summary of the Fiber and Spinning Test Results for Some Varieties of Cotton Grown by Selected Improvement Groups, Crop 1955. Agriculture Information Bulletin No. 152. February 1956.

DEVELOPMENT OF NUMERICAL CONVERSION INDEXES

Basis for Evaluations

The quality or degree of spinning utility of a mass of cotton fibers is made up of combinations of many properties, closely interrelated and interlocked and varying in their contribution to the whole. In addition, there are almost unlimited combinations of processing and manufacturing methods which contribute to different types and qualities of end products and affect final consumer utilization of the finished goods. In a broad sense, this means that certain alternatives exist for evaluating or comparing the quality elements of two or more lots or bales of cotton of reasonably similar commercial classification. One alternative would be to hold constant or to measure rapidly by sight or touch all but one, or perhaps two, of the major elements or properties and to measure the effects of variance in these properties. A practical example of this would be to assemble bales into even running lots by manual classification and then reassemble them on the basis of the Micronaire value, the instrument measurement of fiber fineness. Another alternative is to recognize that (a) most of the world's cotton consumption is of the so-called upland type, in the form of fabric; (b) most of the processing and manufacturing techniques fall into fairly well defined limits; (c) a practicable scheme for evaluating directly competitive growths and qualities of raw cotton can be one under which each measurable property or attribute is recognized and assigned a weighting commensurate with its contribution to the quality or character of the finished product; (d) therefore, the evaluation or comparison can be summarized or reduced to one figure or term and still retain reasonable significance. This latter alternative constitutes the basis for the evaluations of United States and foreign cottons made in this report.

Assignment of Weight Factors

Any specific overall evaluation of raw cotton quality is imperfect because of the many quality elements to be considered and the weightings to be assigned each element. In addition, even for one of the thousands of end products to be used for a specific purpose, there are almost unlimited combinations of manufacturing techniques and processes. Under each technique or practice, the many elements of raw cotton quality may receive different emphasis. The question naturally arises, therefore, whether a simplified and practicable means can be devised for general or overall evaluation of cotton quality, including all of the important grade, fiber, and manufacturing properties. In other words, within limits of the most common uses to which upland cotton is put, how much weight should be given the individual properties included in the grade group, in relation to those comprising the fiber property and manufacturing property groups?

A Hypothetical "Superior" Cotton

As a method of evaluating cotton quality on the basis of the numerous fiber and processing properties that are measurable, a "superior" bale or lot of upland cotton was devised and assumed to possess the highest aggregate rating in terms of grade, fiber, and processing properties that could be expected. Each property was assigned a percentage value for weighting purposes. The assignment of values to each property was based mainly on experience and a careful examination of related published material. The total of the percentage values, 100, is the sum of the grade property values, 25, the fiber property values, 39, and the manufacturing property values, 36. This means generally that, on the basis of average quality of upland type cotton, average manufacturing processes, and the most common end products, it is reasonable to assign about 25 percent of the total value of raw cotton to grade properties, 39 percent to fiber properties, and 36 percent to manufacturing properties, as shown in table 17.

The individual property values assumed for this superior cotton, both as adjective ratings and in the terms by which they are measured, are shown in table 18. Since the units of measurement of the various individual properties are in different terms, such as

TABLE 17.--Example of the calculation of the quality indexes as applied to an assumed "superior" upland cotton

Property	Conversion index	Weight factor assigned	Degree of perfection index ¹	Weighted quality points
Grade group:				
		<i>Percent</i>		
Classer's grade.....	106	5	100	500
Nonlint content (Shirley).....	106	9	100	900
Picker and card waste.....	106	11	100	1,100
Grade total.....	--	25	--	2,500
Grade quality index.....	--	--	² 100	--
Fiber group:				
Length, U.H.M., Fibrograph.....	125	5	100	500
Length, uniformity.....	88	5	100	500
Fineness, Micronaire.....	44	10	100	1,000
Maturity, Causticaire.....	88	4	100	400
Strength, zero gauge.....	95	15	100	1,500
Fiber total.....	--	39	--	3,900
Fiber quality index.....	--	--	² 100	--
Manufacturing group:				
Neps (observation).....	110	3	100	300
Yarn strength (break factor).....	3,500	30	100	3,000
Yarn appearance (judgment).....	130	3	100	300
Manufacturing total.....	--	36	--	3,600
Manufacturing quality index.....	--	--	² 100	--
Total quality points.....	--	100	--	10,000
Overall sample quality index.....	--	--	² 100	--

¹ From table 18.

² Total quality points divided by total weighting factors assigned.

1.5 percent by weight for nonlint content and 3,500 as the average break factor for measuring yarn strength, each of the unit measurements was given a value of 100, or "degree of perfection," to place all of them on a common denominator for determining the "weighted quality point" values for each of the properties as shown in table 17. For example, a weight factor of 5 percent was assigned to classer's grade. Since the assumed grade of the "superior" cotton (Strict Good Middling) is as near "perfection" as could be expected and is, therefore, rated 100, the weighted quality point value for this property is 500. The sum of the weighted quality point values for all of the items in the grade group is 2,500, which, when divided by 25 (the sum of the weight factors for grade), gives 100, which is the quality index for the elements in the grade group. Thus the total weighted quality point value for all contributing properties measured is 10,000; this, when divided by the total weight factor percentages for all groups (100), gives an overall quality index of 100 for this "superior" cotton. By the method, all upland type cottons for which the grade, fiber, and manufacturing properties have been measured may thus be evaluated by comparison with the hypothetical "superior" cotton.

Numerical Conversion Indexes

The numerical conversion indexes were developed from available information, as shown in table 19. In setting up this index for grade, it was necessary to assign a value

TABLE 18.--Grade, fiber, and manufacturing properties and conversion index assumed for a "superior" upland cotton

Property	Unit of measure	Adjective rating	Test rating ¹	Numerical conversion index ²
Grade group:				
Classer's grade.....	U.S. Off. Std.	SGM	2	106
Nonlint content (Shirley).....	% by weight	ext. low	1.5	106
Picker & card waste.....	% by weight	ext. low	5.0	106
Fiber group:				
Length, U.H.M., Fibrograph.....	inches	very long	1.25	125
Length, uniformity.....	ratio	very unifm.	88	88
Fineness (wt. per inch).....	Micronaire	average	4.4	44
Maturity, Causticaire.....	index	very mature	88	88
Strength, zero gauge.....	1000 lb. sq. in.	very strong	95	95
Manufacturing group:				
Neps (observation).....	No. per 100 sq. in. card web	very low	3	110
Yarn strength (break factor).....	index	very strong	3,500	3,500
Yarn appearance (judgment)	index	A.excellent	130	130

¹ Assumed to be the original test data.

² Each property factor is assumed to have a "degree of perfection" index value of 100, or "perfection," as shown in table 17.

TABLE 19.--Numerical conversion indexes assigned for grade, nonlint content, and picker and card waste, as derived from the established index and nonlint content and picker and card waste percentages for specified grades¹

Grade of cotton	Grade index (M=100)	Nonlint content	Picker and card waste	Degree of perfection indexes assigned (SGM=100)		
				Grade	Nonlint content	Picker and card waste
		<i>Percent</i>	<i>Percent</i>			
Strict Good Middling....	106	0- 2.1	4.6- 5.8	100	100	100
Good Middling.....	105	2.2- 2.6	5.9- 6.7	99	99	99
Strict Middling.....	104	2.7- 3.1	6.8- 7.6	98	98	98
Middling.....	100	3.2- 4.2	7.7- 8.6	94	94	94
Strict Low Middling....	94	4.3- 5.9	8.7-10.8	87	87	87
Low Middling.....	85	6.0- 8.2	10.9-14.0	80	80	80
Strict Good Ordinary....	76	8.3-13.7	14.1-17.1	72	72	72

¹ Grade index, nonlint content, and picker and card waste percentages published in Agriculture Information Bulletin No. 152, Agricultural Marketing Service, February 1956.

of 100 to the highest grade, Strict Good Middling. Proportionately lower values were then assigned to grades below Strict Good Middling. Nonlint content and picker and card waste percentages normally expected in specified grades, as shown in table 19, were assigned numerical conversion indexes in a similar manner. Nonlint content and picker and card waste for Strict Good Middling were given index values of 100 and proportionately lower values were computed for grades below Strict Good Middling.

The numerical conversion indexes for length, uniformity of length, maturity, and strength were derived in a similar manner. The values of these properties in the superior cotton were assigned 100 and for each assumed property value the relation of the original test data to 100 was computed. Since the superior cotton was assigned a staple length of 1.25 inches, this length was given a value of 100. In the case of fineness, the Micronaire value of 4.4 is considered the optimum and was therefore assigned an index value of 100. Values for Micronaire readings above and below 4.4 were then computed. The numerical conversion indexes for specified Micronaire values are shown in table 20.

TABLE 20.--Micronaire values and the corresponding numerical conversion index

[4.4 = 100]

Micronaire value	Numerical conversion index	Micronaire value	Numerical conversion index
3.5	80	4.5	96
3.6	82	4.6	95
3.7	84	4.8	92
3.8	86	4.9	90
3.9	89	5.0	88
4.0	91	5.1	86
4.1	93	5.2	85
4.2	95	5.3	83
4.3	98	5.4	81
4.4	100	5.5	79

The numerical conversion and degree-of-perfection indexes for neppiness are shown in table 21, along with adjective descriptions and class intervals of the number of neps per 100 square inches of card web, based on a card production rate of 9-1/2 pounds per hour.

TABLE 21.--Numerical conversion and degree of perfection indexes for neppiness

Adjective description	Neps per 100 square inches of card web	Numerical conversion index (0-6=100)	Degree of perfection index (0-6=100)
	<i>Number</i>		
Very low.....	0-6	120	100
Low.....	7-15	115	96
Average.....	16-30	100	83
High.....	31-45	85	71
Very high.....	46 and over	70	58

The yarn appearance index was used as published in Bulletin No. 152, the top grade index of 130 being the basis, or 100, and index values for lower grades were computed, as shown in table 22.

TABLE 22.--Numerical conversion and degree of perfection indexes for designated grades of yarn, with adjective descriptions and published yarn appearance index

Yarn grade	Adjective description	Yarn appearance index (Average = 100)	Numerical conversion index (Average = 100)	Degree of perfection index (Excellent = 100)
A and above.....	Excellent	130	130	100
B+.....	Very good	120	120	92
B.....	Good	110	110	85
C+.....	Average	100	100	77
C.....	Fair	90	90	69
D+.....	Poor	80	80	62

The superior cotton was assigned a yarn break factor value of 3,500. The numerical conversion indexes for all other yarn strengths were computed on the basis of 3,500 = 100.

DEVELOPMENT OF DEGREE OF PERFECTION INDEXES

The degree of perfection index is simply an index value reflecting the relationship of the numerical conversion index to the value assigned to the superior cotton. For example, in the grade index for marketing purposes, as shown in table 19, Middling equals 100; grades above Middling have higher index values and those below Middling have lower values. In the degree of perfection index, however, the highest grade, Strict Good Middling, was assigned a value of 100 and proportionately lower index values were computed for each lower grade.

In the case of length, length uniformity, maturity, fineness, strength, number of neps, and break factor of yarn, index values have never been reported. Therefore, some procedure was needed to convert adjective descriptions to index values for calculations of overall quality indexes for the sample lots tested. In these cases, the numerical conversion index and the degree of perfection index are identical and were obtained by dividing the original test data by the respective property values assigned to the superior cotton.

