STUDIES OF AMERICAN UPLAND VARIETIES OF COTTON WITH REFERENCE TO CERTAIN FIBER PROPERTIES

by

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INTRODUCTION

Increased foreign competition and changing mill demands for cotton of different characters create a pressing need for progress and improvement work in cotton. Not alone must staple-length and uniformity of American cotton continue to be improved; it is necessary to breed into the new strains other quality factors. Farmers who produce cotton of the characteristics for specific uses desired by the manufacturers should benefit by an increased demand for their product.

The ultimate purpose of this study, then, is to survey and compare the fiber qualities of various upland and foreign cottons to determine their potential uses in industry and as a source of breeding stock for improvement of present commercial varieties.

METHOD OF TREATMENT

Boll samples of a large number of cotton varieties were collected on September 25, 1946, in the vicinity of Tucson, Arizona, from an ordinary field planting. Each sample consisted of 1 boll from each of 5 plants per variety-row taken at even distribution from bottom to top of plants spaced 14 inches apart in 39-in rows. Each sample was placed in a paper sack, labelled, and brought to the laboratory for study. The study consisted, mainly, of tests on staple-length, strength, fine-

ness, moisture regain capacity, and maturity. Other tests included lint weight, lint index, seed weight, seed index, ginning percentage, and fuzziness.

Staple length. Staple length was determined by placing the combed seed samples on a measuring card. The length recorded was that between the raphe on the seed and the mean of the extreme margin of the fibres. The "mean of the extreme margin" as used here corresponds with what is known as "staple length" in the cotton trade.

Strength Index was determined by the Pressley Index method (1). The ginned cotton of each sample was spread on a flat surface. Thirty pinches per variety were taken at random and rolled into a roving 10 to 12 inches long. The roving was broken in two; the two halves were rolled together, and again broken in half. The process was repeated until each sample was thoroughly mixed. From this mixed lot a representative small sample was passed through a fine comb and placed in the clamps of the Pressley Breaking machine. The force required to break the sample was recorded. While in the clamp, the samples were cut to a uniform length (that of the clamp) and weighed on a milligram balance. The procedure was repeated three times per 5-boll sample.

The sum of the three weights per sample was divided into the sum of the forces required to break the samples to obtain the number of pounds required to break 1 milligram of cotton fibers, thus getting the strength index:

$$\text{Strength Index} = \frac{\text{Total force required (Lbs)}}{\text{Total weight of Sample (Mgs)}}$$

Fineness of Fibers. A small pinch of cotton fibers was combed, placed on a piece of cellophane on the clamps of the Pressley Breaking machine and a uniform length ($\frac{1}{2}$-inch) of fibers obtained by cutting at each end of the clamp. The cellophane paper with attached fibers (the pressure applied to the clamps attached the fibers to the cellophane paper) was placed under a high power microscope and the fibers were counted. Without disturbing the fibers, the sample was placed on a milligram balance and the total weight was recorded. The difference between the total weight and the weight of the cellophane alone gave the weight of the fibers. Division of the fiber weight by the number of fibers gave the weight in milligrams per $\frac{1}{2}$-inch fiber length; this, multiplied by 100, gave the weight recorded.

$$\text{Individual Fiber Weight} = \frac{\text{Weight Sample (Mgs)}}{\text{Number of Fibers}}$$

$$\text{Sample Weight} = \text{Individual Fiber Weight} \times 100$$

Moisture Regain. The various samples of ginned cotton were placed in weighing cans and left exposed to controlled atmospheric conditions of 65 percent relative humidity and 70 degrees Fahrenheit in the laboratory for two days. After weighing, the samples were placed in the drying oven at 212 degrees Fahrenheit for 1 hour (samples ceased to loose weight after 1 hour). The can weight was subtracted from the can plus sample

weight after drying to get the weight of the dry cotton. The weight of the can plus the dry sample was subtracted from the weight of the can plus wet sample to get the total moisture lost.

$$\text{Moisture Lost} = (\text{Wt. Wet Cotton}) - (\text{Wt. Dry Cotton})$$

$$\text{Moisture Regain} = \frac{\text{Moisture Lost (g)}}{\text{Wt. Dry Cotton (g)}} \times 100$$

Maturity Index. Fiber maturity was obtained by the Shirley Institute method (2) in which the mature and immature fibers are counted under high power magnification after treatment with an 18 percent aqueous solution of sodium hydroxide. Three samples of 100 fibers each were counted and the average recorded.

$$MI = \frac{10(m) + 6(i)}{N/10}$$

The formula above was used to convert the data concerning fiber maturity into a single factor. MI represents the maturity index, m the number of mature fibers in the sample, i the immature fibers, and N the total number of fibers in the sample. The fibers intermediate in maturity were counted as immature.

Weight Lint. The locks of each of the samples were picked from the bur. Five seeds with lint attached per sample were taken at random for other fiber determinations and the remainder of the seed-cotton was ginned on the laboratory roller gin. The lint weight thus taken was recorded.

Weight Lint = Wt. Cotton Ginned per Sample

Lint Index was obtained by dividing the weight of the seeds

per 5-boll sample by the product of the percentage seed and the percentage lint:

$$\text{Lint Index} = \frac{\text{Wt. Seeds per Sample}}{(\%\ \text{Seed}) \times (\%\ \text{Lint})}$$

Seed Weight. The seeds from each 5-boll sample were weighed and the weight recorded in grams.

Seed Index. The weight of 100 seeds per 5-boll sample was recorded in grams.

Ginning Percentage. The weight of lint of each sample was divided by its corresponding seed-cotton weight and the quotient multiplied by 100 to obtain the ginning percentage:

$$\text{Ginning Percentage} = \frac{\text{Wt. Lint (g)}}{\text{Wt. Seed-cotton (g)}} \times 100$$

Percent Fuzziness. Seeds of each 5-boll sample were weighed after ginning and placed in a beaker with one-third part by weight of concentrated sulphuric acid. After constant and uniform agitation with a glass rod, the delinted seeds were rinsed with running water, dried, and weighed. The difference between the first and second weights gave the weight of fuzz in grams per sample. Percent fuzz was then calculated by the following formula:

$$\text{Percent Fuzz} = \frac{\text{Wt. Fuzzy Seeds (g)}}{\text{Wt. Delinted Seeds (g)}} \times 100$$

DISCUSSION AND RESULTS

All varieties, 68 for most tests, used in this study were grown in a limited area under the same seasonal, climatic, and cultural conditions and which in the main represent varieties that have been at one time or another produced on a commercial basis. Any differences, therefore, are due to the cotton itself, soil variations, or both.

The average climatic conditions prevailing during the growing season were as reported in table 1. Weeds and insects were kept to a minimum. The elevation for the area is 2,423 feet.

Table 1. Monthly Average Temperature and Rainfall, Tucson Station, 1946

Month	Mean Temperature (°F)	Monthly Rainfall (inches)
January	47.0	1.90
February	50.8	0.38
March	59.9	0.55
April	70.7	0.09
May	72.6	0.00
June	83.8	0.02
July	85.5	2.84
August	83.6	4.62
September	80.6	1.05
October	63.3	0.83
November	52.6	0.89
December	52.2	0.50
Average Temperature	66.8	
Total Rainfall		13.67

Staple length. Cotton with fiber less than 1 1/8 inches long generally is termed "short-staple" cotton, while cottons having a staple over this length usually are referred to as "long-staple" cottons. The length of fibers within a single lot of cotton varies considerably, especially for the cottons with extra staple length. Humbert and Mogford (3) studied closely the length of lint in all the bolls of a cotton and they found variations in lint length to occur in different parts of the plant, in different parts of the same boll, and in the same lock. The staple-length data reported in column (1) of table 7 are the average length of the fibers while they are attached to the cotton seed.

There are 29 individuals above, 24 below, and 16 within the mean group of 1.02 inches. The average deviation was .125 inches. Comparisons between varieties from the standpoint of their frequency distribution in fiber length were made according to the following designations:

Staple length

(In thirty-seconds)

40 and above	Very long staple
35 to 39	Long
32 to 34	Average
28 to 31	Short staple
27 and below	Very short

Meade 3, Meade 71A, and Wilds 9 are in the first group. Included in the long-staple group are Ewings L. S., Durango 5, Kekchi 4, Delfos 6102-6112, Delfos 425, and Acala Rogers. In the mean group are Stoneville 4, Coker 144-68, Santan 25, Stoneville 5, Youngs Acala, Acala P 22, Q. C. Acala, and Red Acala. Included in the short-staple group are Cooks 307-6, Petty Toole, Burnett, and Mexican Big Boll. The group with very short staple includes Half and Half, Westex, Garo Hill, Naked Seed Acala, King 82, Mebaken, G. Nanking, and Seabrook Tidewater.

A definite relationship was found between staple length and fineness of fiber (Table 3).

Strength index data are reported in column (2) of table 7. The average strength index for the high group was 774.04. That for the mean group was 730 and for the low group, 635.95. There were 22 varieties in those classes in the high strength index groups, 4 in the mean group, and 44 in those classes below the mean group. The average deviation for all samples was 63.4. Of the 22 varieties in the high group, Durango 5, Westex, Wilds 2, Meade 3, Mebaken, and Okra Leaf Acala were very high in strength. Also in the high group were Columbia, Coker 144-68, Red Acala, Stoneville 4, D-P. L. 4-8, Burnett, Acala Rogers, Meade 71A, Youngs Acala, and Holden. In the low strength index group, among others, were King 67, Wannamaker E. W., D. T. 12, Stoneville 2B, Ballard, Wilds 1, Seabrook Tidewater, Garo Hill, and Acala 5; Coker Seven 4, Acala P22, Delfos 6102-531,

Q. C. Acala, Trice, Santan 25, Misdell 4, and G. Nanking were among the lowest.

Durango 5 was 167 units above the mean. G. Nanking, on the other hand, was 199 below. There were 366 units between high and low. The values reported under this character are classified as follows:

Fiber strength
(Pounds per milligram)

800 and above	Very strong fibers
740 to 799	Strong
720 to 739	Average
660 to 719	Low strength
659 and below	Weak

Brown (4) reported that "the strength of a fiber depends principally on the thickness of its cell wall" and that "the strength of mature, well developed fibers is, in general, in proportion to their diameter". There was no significant co-relation found in this study, however, between strength index and any of the following: staple length, maturity index, and fineness of fibers (Table 3).

Fiber fineness data are reported in table 3 and in column (3) of table 7, expressed in terms of weight in milligrams per 100 $\frac{1}{2}$-inch fibers. The larger the figure reported the coarser the fibers. As a general rule, coarse fibers are short and fine fibers are long. For the purpose of comparison, the

following descriptive ratings were applied:

Fiber fineness
(Milligrams per 100 fibers of uniform length)

.200 and below	Very fine
.201 to .300	Fine
.301 to .400	Average fineness
.401 to .450	Slightly coarse
.451 and above	Coarse

Only 10 varieties were tested for fineness. It was observed that as fiber fineness increased, staple length also increased (Table 3).

Moisture regain capacity. Data on moisture regain capacity of the 68 varieties tested are reported in column (4) of table 7. There was a frequency of 19 individuals in the mean class between 7.45 and 7.64 percent, the largest of 8 classes. Included in this group in decreasing order were King 67, Delfos 6102-6112, Coker Lightning Express 8, Coker 4 in 1, Wilds 1, Coker Seven 4, Red Okra Leaf Acala, Sikes W. R., Wannamaker D. T., Cooks 307-6, Coker 144-68. Of 29 individuals in the high group class between 7.65 and 8.17 were, in decreasing order, Kekchi, Meade 3, Wilds 9, Red Acala, Stoneville 5, Stoneville 4, Westex, Seabrook Tidewater, Santan 182, Acala Rogers, Hartsville, Santan 25, and Q. C. Acala. In the low group of 20 individuals between 7.04 and 7.43 percent were Mexican Big Boll, Columbia, Oklahoma Triumph 44, D. T. 12, and others, the

lowest of which was D-P. L. 4-8. The average deviation of the total group was .21 percent. In order to compare the different varieties, the following ratings have been applied:

Moisture regain capacity	
7.65 and above	High moisture regain
7.45 to 7.64	Average
7.44 and below	Low moisture regain capacity

No definite relationship was found between moisture regain capacity of cotton and other fiber characteristics. It was noted that moisture regain capacity did not vary much within the upland varieties. From a preceding study on the topic, significant and substantial differences were obtained between upland varieties and Egyptian cottons (Table 2). The 5 Egyptian varities had a higher moisture regain capacity than did any of the 5 upland varieties studied.

Table 2. Moisture Regain Capacity of Upland and Egyptian Varieties of Cotton.

Variety Number	Upland	Egyptian
1	6.92	7.48
2	6.93	7.47
3	6.87	7.55
4	6.89	7.49
5	6.98	7.48
Average	6.92	7.49

Fiber maturity is reported in column (5) of table 7. The data in table 3 show the tendency for rough cottons to be highly

mature, and conversely, for fine cottons, to be immature. This is contrary to popular belief. Maturity is obtained by examining the fibers under high magnification to determine the relative thickness of the fiber cell walls. After treatment with an 18 per cent solution of sodium hydroxide, the mature fibers are straightened into rods. The immature fibers remain convoluted or show immaturity by having thin cell walls.

Varieties having a high maturity index were Q. C. Acala, Oklahoma Triumph 44, College, Garo Hill, Durango 5, King 67, Santan 25, and Wannamaker Cleveland W. R. Varieties having a low maturity index were Lone Star, Wilds 1, Santan 182, Cooks 307-6, Stoneville 2B, Meade 3, Delfos, and Delfos 425. For comparisons, the following descriptive ratings have been applied:

Maturity index	
98 and above	Very highly mature
95 to 97.9	Highly mature
90 to 94.9	Average maturity
80 to 89.9	Low
79.9 and below	Very immature

Unlike with other fiber characteristics studied, individual frequency is higher in the upper class values and gradually decreases. Of the 69 individual varieties examined, 27 were above, 22 below, and 20 were in the mean class between 90 and 95. The average deviation for the total group is 6.13

units. The high maturity index found for many varieties may have been due, in part, to the combing of the sample, since immature fibers are weaker and more easily detached than the mature ones. The element of human judgment also may have had some effect.

There appears to be no significant correlation between staple length and maturity index other than the tendency for the varieties with an average staple length to be more highly mature.

Table 3. Comparisons Between Staple Length, Strength, Fineness, and Maturity of Fibers.

Variety	Staple Length (Inches) Value	Rank	Strength Index Value	Rank	Fineness Mgs/100 Value	Rank	Maturity (Index) Value	Rank
Meade 3	1 1/2	1	823	1	.128	1	70.0	9
Delfos 425	1 5/32	4	692	6	.192	2	65.2	10
Youngs Acala	1 1/16	6	747	3	.204	3	95.0	4
Meade 71A	1 10/32	2	750	2	.208	4	83.2	8
Delfos 6102-531	1 1/8	5	576	10	.228	5	94.8	5
Delfos 6102-6112	1 5/32	3	643	8	.242	6	91.2	7
Mexican Big Boll	28/32	8	660	7	.320	7	98.4	2
Acala 5	1	7	698	5	.369	8	91.2	6
Half and Half	26/32	9	621	9	.402	9	98.0	3
Garo Hill	25/32	10	699	4	.465	10	98.8	1

Lint weight. Data on lint weight in grams per sample and the rank of the 68 varieties tested are reported in column (6) of table 7. The mean class value of the group is 11.45 grams; there are 12 individuals in this group, 25 above, and 31 below. In the high lint weight are Lone Star, Acala P22, Oklahoma Triumph 44, Half and Half, Q. C. Acala, Santan 182, Stoneville

2B, Santan 25, and others. The mean group includes Marrids D. T., Wannamaker D. T., Acala Rogers, Ewings L. S., Delfos, Delfos 6102-6112, and Delfos 6102-531. In the low group, in decreasing order are Wilds 9, Durango 5, Garo Hill, King 82, Acala 5, Meade 3, Meade 71A, Naked Seed Acala, and the lowest, Mebaken, with 9.75 grams below the mean. The class value of Mebaken is 1.7 grams. The average deviation between members of the group is 2.1 grams. Lint weight as used here is the total weight of cotton ginned per sample. For practical purposes, comparisons between samples from the standpoint of lint weight were made according to the following descriptive designations:

Lint weight per 5-bolls (grams)	
11.9 and above	High lint weight
11.0 to 11.8	Average
10.9 and below	Low

Lint index. Lint index differs from lint weight in that in the former the seed weight of the sample was included in the calculations. There is a close relationship between the two (Table 4). Lint index is of no considerable value to cotton growers because it gives no measure of the yield of lint per acre; it is the weight in grams of lint ginned per 100 seeds and generally varies from 4 to 8. For the purpose of comparison, the following descriptive terms were applied to the weight data reported in column (7) of table 7:

Lint index (grams)	
9.0 and over	Very high lint index
8.0 to 8.9	High
7.0 to 7.9	Average
4.0 to 6.9	Low
3.9 and below	Very low.

It will be noted that the mean class group with a value of 7.2 has a higher frequency of individuals than any other one class value; there are 12 individuals in the mean group, a total of 28 in 8 classes above, and a total of 28 in 6 classes below this group. The average deviation of the total group is 1.1.

Many varieties with a high lint index are also leading varieties in lint weight. With a very high lint index are Half and Half, Lone Star, Miller 610, Acala P22, Seabrook Tidewater, and Oklahoma Triumph 44. Santan 182, Youngs Acala, Wilds 1, and Q. C. Acala follow in the high lint index group. In the mean group are included Misdel 4, Sikes W. R., Kekchi 4, Stoneville 5, Wilds 2, Delfos 6102-531, Spears L. S., Garo Hill, Delfos, and others. Cleveland 54, Burnett, Coker Lightning Express, Meade 3, King 82, and Acala 5 are in the low group while Naked Seed Acala and Mebaken are in the very low lint index group.

Table 4. Comparison Between Lint Weight and Lint Index.

Variety	Lint Weight (grams) Value	Rank	Lint Index Value	Rank
Lone Star	17.9	1	10.55	2
Acala P22	17.4	2	9.58	3
Oklahoma Triumph	15.5	3	9.10	4
Half and Half	15.2	4	11.90	1
Santan 182	14.7	5	8.89	5

Seed weight per 5-boll sample. There are 9 individuals in the mean class value of 21.45 grams, 28 above and 31 below this group. The range of the total group is from 9.45 to 29.45 grams with an average deviation of 2.7 grams. Some of the leading varieties in seed weight are Kekchi 44, Lone Star, Acala P22, Q. C. Acala, Oklahoma Triumph 44, Delfos 6102-6112, Stoneville 2B, Stoneville 4, Okra Leaf Acala, Wannamaker D. T., Cokers Seven 4, Stoneville 5, Acala 5, Cleveland 54, Wilds 2, Coker 144-68, and Miller 610. Naked Seed Acala, Cooks 307-6, Seabrook Tidewater, King 82, Okra Leaf Acala, and Garo Hill are the lowest in the low group. Data on seed weight are reported in column (8) of table 7. The following ratings have been applied:

Seed weight per 5-boll (grams)	
28 and above	Very high
22 to 27.9	High
19 to 21.9	Average seed weight
14 to 18.9	Low
9 to 13.9	Very low

Seed index. By comparing columns (2) and (3) of table 5, more can be told of the seed size and weight of the variety because bolls of upland cottons contain 4 or 5 locks, containing approximately 36 or 45 seeds each. This fact, to a great extent, explains the variation existing between seed weight and seed index. The following descriptive designations aided in evaluating the results reported in column (9) of table 7:

Seed index	
15.0 and above	High seed index
12.0 to 14.9	Average
11.9 and below	Low seed index

The mean class value for the group was 13.45. Included in this group of 12 individuals were Wannamaker D.T., Mebaken, Red Acala, D.T., 85, Ballard, and Wannamaker E.W. Hartsville, Wilds 1, Wilds 9, Kekchi 4, Lone Star, and Holden were in the high group of 34 individuals while Red Okra Leaf Acala, D-P.L. 44.51, Coker 100, Cooks 307-6, Petty Toole, and Garo Hill were in the group of 22 individuals having a low seed index. The average deviation for the total group was 1.6. It was noted that Hartsville, the leading variety in this respect, was 4.6 units above the mean; Garo Hill, on the other hand, had the lowest value, namely, 5.2 units below the mean.

Ginning percentage. The mean ginning percentage of the group was 34.4 percent and the average deviation was 3.7. By excluding Mebaken and Naked Seed Acala, two varieties having

a decidedly low ginning percentage (10.95 percent), the mean was raised by .72 percent and the average deviation was lowered by .58 percent; this exclusion made 25.45 percent the lowest class value of the group. For the purpose of this study, therefore, Mebaken and Naked Seed Acala were excluded from the ginning percentage data reported in column (10) of table 7. There were 7 individuals in the mean group, 26 above, and 33 below this group.

Half and Half, first in the group, had a ginning percentage of 45.7 and Garo Hill, second, 45.0 percent. Other leading varieties included D-P.L. 44-51, Cooks 307-6, D.P.L. 4-8, College, Acala P22, Red Okra Leaf Acala, and Seabrook Tidewater. Mexican Big Boll, Wannamaker E.W., C.C., Acala, Marrids D.T., and Wannamaker Cleveland W.R. were in the mean group. Varieties with a low ginning percentage included Petty Toole, Coker Foster 4, Wilds 9, Holden, Delfos 6102-6112, Kekchi, Trice, Meade 71A, Meade 3, and Acala 5.

Half and Half was 10.57 percent and Garo Hill 9.87 percent above the mean class value of 35.12 percent. Meade 71A, Meade 3, and Acala 5, on the other hand, were an average of 8.45 percent below the mean. For the purpose of comparisons, the following ratings were applied:

Ginning percentage	
40 and above	Very high
36.0 to 39.9	High
35.0 to 35.9	Average
31.0 to 34.9	Low
30.9 and below	Very low

According to Brown (4) lint percentage is determined by at least three factors: The number of fibers per unit area of seed surface, the size of the fibers, and the weight of the seed. He reported that some of the short-staple varieties with a high lint percentage have many more fibers per seed than do the varieties with longer staple and lower percentage; the size of the individual fibers is a factor of relatively little importance in lint percentage because long fibers have a small diameter and short ones are relatively thick, thus tending to balance each other. That report is substantiated by comparing columns (1) and (10) of table 7. The weight of the seed is another factor of importance in lint percentage. Varieties with high lint percentages usually had smaller seeds while some varieties with low percentage had larger seeds (Table 5).

Fuzziness percent. Of 68 varieties tested for fuzziness, 15 individuals were in the mean class group of 10.95 percent, 32 in the high group, and 20 were below. The average deviation for the total group was 3.1 percent. Data on fuzziness are reported in column (11) of table 7.

Miller 610 had approximately 50 percent more fuzz than

the mean group and 100 percent more than Naked Seed Acala. There was no significant correlation between size of seed and fuzziness percent. From the standpoint of fuzziness, the varieties were classified as follows:

Fuzziness (Percent)	
15.0 and above	Very high
12.0 to 14.9	High
10.0 to 11.9	Average
6.0 to 9.9	Low
5.9 and below	Very low

Table 5. Comparison between Ginning Percentage, Seed Weight, and Seed Index.

Variety	Ginning Percentage		Seed Weight (grams)		Seed Index	
	Value	Rank	Value	Rank	Value	Rank
Half and Half	45.7	1	18.0	15	14.1	9
Garo Hill	45.0	2	9.9	21	8.7	21
D-P. L. 44-51	42.4	3	18.5	13	11.1	18
Cooks 307-6	41.5	4	15.5	18	10.9	20
D-P. L. 4-8	41.0	5	17.5	16	12.1	14
College	39.8	6	19.3	12	12.9	12
Acala P22	39.5	7	26.5	2	14.7	5
Red Okra Leaf Acala	39.3	8	14.2	20	11.2	17
Seabrook Tidewater	39.2	9	15.5	18	14.4	8
Cokers 100	39.1	10	19.7	10	11.0	19
Lone Star	38.9	11	28.0	1	16.6	1
Acala Rogers	38.3	12	18.5	11	12.7	13
Youngs Acala	38.2	13	22.4	6	14.6	6
Cokers 144-68	38.2	13	20.3	8	13.0	11
Santan 182	38.1	15	23.8	5	14.6	6
Miller 610	38.0	16	20.0	9	16.0	3
D. T. 06-366	37.7	17	16.6	17	11.4	16
Santan 25	37.2	18	24.0	4	16.4	2
Oklahoma Triumph 44	36.8	19	26.5	2	15.6	4
Red Acala	36.7	20	22.4	6	13.8	10
Delfos	36.6	21	19.5	11	11.9	15

Among the leading varieties in fuzz percentage were Miller 610, D. T. 12, Sikes W. R., Wilds 1, Cleveland 54, Durango 5, Santan 25, Rowden 2088, Coker 4 in 1, Garo Hill, Delfos 6102-531, Coker 100, Wannamaker D.T., Columbia, Wannamaker, and Youngs Acala. Santan 182, Coker Foster 4, Dixie 14-5-6, Petty Toole, Wannamaker E. W., Ewings L. S., D-P.L. 4-8, D-P. L. 44-51, Delfos 425, Wilds 2, Acala Rogers, Burnett, Stoneville 5, Q. C. Acala, and D. T. 85, were in the mean group. In the low fuzziness group were Cooks 307-6, Wannamaker Cleveland W. R., King 67, Red Okra Leaf Acala, Trice, Seabrook Tidewater, Wilds 9, Cokers Seven 4, Red Acala, Spears L. S., College, Westex, Half and Half, Meade 3, Meade 71A, and D. T. 366

Table 6. High, Mean, and Low Values for Eleven Cotton Characteristics.

Character	High	Mean	Low
Staple length (in)	1.50	1.01	.59
Strength index	895.00	728.09	529.00
Fiber fineness (mg)	.13	.27	.46
Moisture regain (%)	8.17	7.58	7.04
Maturity index	99.20	90.38	65.20
Lint weight (g)	17.90	11.16	1.70
Lint index	11.90	7.21	1.46
Seed weight (g)	29.50	20.54	9.90
Seed index	18.50	13.92	8.70
Ginning percent	45.70	35.13	25.60
Fuzziness percent	20.29	11.64	0.00

Table 7. Comparison of Staple Length, Strength Index, Fineness, Moisture Percentage, Maturity Index, Weight Lint, Lint Index, Weight Seed, Seed Index, Ginning Percentage, and Fuzziness of Various Upland Cotton Varieties.

	(1) Staple Length (Inches)		(2) Strength Index		(3) Fiber Fineness (mg		(4) Moisture Regain		(5) Maturity Index		(6) Weight Lint (g)		(7) Lint Index		(8) Seed Weight (g)		(9) Seed Index		(10) Ginning Percentage		(11) Percentage Fuzziness	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
Meade 3	1 1/2	1	823	4	.128	1	8.10	2	70.0	67	6.4	65	5.73	61	17.5	57	15.5	12	26.7	65	7.42	61
Meade 71A	1 10/32	2	750	13	.208	5	7.65	29	83.2	59	6.1	66	6.22	54	16.0	61	16.0	8	27.6	64	3.72	63
Wilds 9	1 10/32	2	740	21			8.07	3	85.6	55	8.4	60			18.8	48	18.0	3	30.8	59	9.09	52
Ewings L. S.	1 6/32	4	617	58			7.72	19	86.4	52	11.4	29	6.65	46	23.5	15	13.3	45	32.6	48	11.39	38
Durango 5	1 6/32	4	895	1			7.70	21	98.8	4	8.2	61	6.16	55	16.5	60	12.8	49	33.1	44	17.05	6
Kekchi 4	1 5/32	6	610	60			8.17	1	96.4	18	12.5	20	7.37	31	29.5	1	17.4	4	29.7	62	13.46	25
Wilds 1	1 5/32	6	706	32			7.59	34	78.8	63	10.4	44	8.74	9	20.9	29	18.2	2	32.4	52	17.56	4
Delfos 6102-6112	1 5/32	6	643	51	.242	6	7.61	30	91.2	44	11.1	34	6.54	49	26.0	6	15.5	12	30.0	60	13.56	23
Acala Rogers	1 5/32	6	750	13			7.85	10	94.4	29	11.5	26	7.67	25	18.5	50	12.7	50	38.3	12	10.64	43
Delfos 425	1 5/32	6	692	38	.192	2	7.47	46	65.2	69	9.5	52	6.41	52	18.6	49	12.9	47	33.5	40	11.23	41
Sikes W. R.	1 5/32	6	604	61			7.55	37	85.6	55	10.5	42	7.47	29	19.3	44	14.5	29	34.2	37	8.13	3
Spears L. S.	1 1/8	12	661	46			7.52	40	93.2	37	10.0	48	7.13	35	19.8	38	14.7	22	33.5	40	8.54	57
Columbia	1 1/8	12	799	7			7.42	50	98.0	10	9.0	57	6.07	57	19.5	41	13.4	41	31.5	56	14.72	14
Wilds 2	1 1/8	12	828	3			7.48	44	98.0	10	11.3	30	7.30	33	20.3	35	12.6	52	35.7	29	11.00	42
Wannamaker	1 1/8	12	675	44			7.78	16	96.0	19	12.2	22	7.88	20	24.8	10	15.9	10	33.5	40	14.40	15
Holden	1 1/8	12	746	16			7.67	27	93.6	34	9.6	51	6.86	41	22.3	21	16 4	6	30.0	60		
Delfos 6102-531	1 1/8	12	576	64	.228	4	7.25	59	94.8	28	11.1	34	7.21	34	21.9	24	14.3	32	33.6	38	15.38	11
D. T. 12	1 1/8	12	709	21			7.39	52	93.6	34	9.9	50	6.07	57	21.9	24	13.4	41	31.1	57	19.47	2
[illegible]	1 1/8	12	[illegible]	20			7.70	21	70.4	66	14.5	7	8.15	16	25.6	7	14.6	25	36.1	25	14.11	19
Delfos	1 1/8	12	632	53			7.46	47	68.0	68	11.3	30	7.05	37	19.5	41	11.9	59	36.6	22	14.28	18
Cokers Seven 4	1 1/8	12	603	62			7.59	34	95.0	25	10.3	46	6.65	46	20.6	31	13.4	41	32.7	47	8.73	55
Misdel 4	1 1/8	12	538	68			7.72	19	88.0	48	10.5	42	7.47	29	19.2	47	14.6	25	34.3	35	12.50	29
D-P. L. 44-51	1 3/32	23	640	52			7.25	59	86.8	51	13.6	11	7.98	18	18.5	50	11.1	64	42.4	3	11.29	40
Coker Foster 4	1 3/32	23	620	57			7.66	28	87.9	49	10.2	47	6.74	44	22.2	22	15.0	18	31.0	58	11.66	34
Santan 182	1 3/32	23	622	55			7.86	9	75.2	64	14.7	5	8.89	7	23.8	13	14.6	25	38.1	16	11.91	33
Wannamaker E. W.	1 3/32	23	717	28			7.24	61	93.6	34	10.6	40	5.59	27	18.0	53	13.5	39	35.8	28	11.53	37
Coker 4 in 1	1 3/32	23	692	38			7.60	33	86.4	52	10.6	40	7.72	24	19.8	38	15.1	16	33.6	38	15.73	9
Hartsville	1 3/32	23	724	26			7.84	11	80.0	61	11.3	30			23.9	12	18.5	1	32.1	53	12.71	28
Okra Leaf Acala	1 3/32	23	808	6			7.51	42	95.0	25	14.2	9	8.43	10	24.5	9	15.2	15	36.3	24	14.28	17
Stoneville 4	1 1/16	30	769	10			7.94	6	98.0	10	13.2	12	8.35	13	24.8	8	15.4	14	34.7	34	12.90	27
Coker 144-68	1 1/16	30	781	8			7.52	40	94.0	32	12.6	18	7.97	19	20.3	35	13.0	46	38.2	14	12.31	30
Santan 25	1 1/16	30	554	67			7.83	12	98.8	4	14.3	8	7.80	22	24.0	11	16.4	6	37.2	19	16.59	7
Stoneville 5	1 1/16	30	645	50			7.96	4	84.0	58	12.8	15	7.35	32	20.6	31	12.0	56	38.3	12	10.52	45
Youngs Acala	1 1/16	30	747	15	.204	3	7.50	43	95.0	25	13.9	10	8.89	7	22.4	18	14.6	25	38.2	14	14.35	16
Acala P22	1 1/16	30	580	63			7.77	17	85.6	55	17.4	2	9.58	4	26.5	3	14.7	22	39.5	7	12.22	32
Q. C. Acala	1 1/32	36	568	65			7.82	13	99.2	1	14.7	5	8.43	10	26.5	3	15.1	16	35.6	30	10.37	46
Red Acala	1 1/32	36	773	9			7.96	4	94.4	29	13.0	13	8.22	15	22.4	18	13.8	36	36.7	21	8.55	56
Cokers 100	1 1/32	36	647	49			7.34	56	97.6	14	12.7	17	7.03	38	19.7	40	11.0	65	39.1	10	15.15	12
Cokers Lightning Express 8	1 1/32	36	741	20			7.61	30	96.0	19	8.6	58	5.88	59	18.2	52	12.6	52	32.0	54	13.58	22
Wannamaker D. T.	1 1/32	36	676	43			7.55	37	92.0	40	11.5	26	7.54	28	20.9	29	13.9	35	35.4	31	14.97	13
Acala 5	1	41	698	35	.369	8	7.79	14	91.2	44	7.1	64	5.10	64	20.5	33	14.4	30	25.6	66	1.46	66
Miller 610	1	41	625	54			7.70	21	95.2	23	12.3	21	9.81	3	20.0	37	16.0	8	38.0	17	20.29	1
Ballard	1	41	707	31			7.68	26	96.0	19	12.0	25	6.65	46	23.8	13	13.5	39	33.5	40	2.85	64
D. T. 85	1	41	693	37			7.79	14	86.0	54	11.3	30	6.89	40	22.9	17	13.8	36	33.0	45	10.13	47
Lone Star	31/32	45	677	42			7.54	39	78.9	62	17.9	1	10.55	2	28.0	2	16.6	5	38.9	11	14.09	20
Oklahoma Triumph 44	31/32	45	675	44			7.41	51	99.2	1	15.5	3	9.10	6	26.5	3	15.6	11	36.8	20	12.31	30
Marrids	31/32	45	740	21			7.22	63	90.8	46	11.5	26	6.74	44	21.2	28	12.4	54	35.1	32	13.61	21
Dixie 14-5-6	31/32	45	734	23			7.38	53	97.2	16	10.9	38	6.82	42	21.8	26	14.3	32	31.6	55	11.62	35
D. T. 06-366	30/32	49	730	25			7.24	61	95.2	23	10.4	44	6.75	43	16.6	59	11.4	61	37.7	18	6.74	62
Rowden 2088	30/32	49	686	40			7.22	63	96.8	17	12.9	14	8.43	10	22.4	18	15.0	18	36.5	23	15.86	8
Cleveland 54	30/32	49	658	48			7.16	67	95.6	22	10.8	39	5.91	20	20.4	34	12.0	56	33.0	45	17.30	5
D-P. L. 4-8	29/32	52	765	11			7.04	68	92.4	39	12.2	22	8.34	14	17.5	57	12.1	55	41.0	5	11.30	39
King 67	29/32	52	718	27			7.63	30	98.8	4	9.3	53	5.64	63	19.3	44	12.0	56	32.5	50	9.32	50
Red Okra Leaf Acala	29/32	52	745	17			7.56	36	87.0	49	9.2	55	7.03	38	14.2	67	11.2	63	39.3	8	9.22	51
Cooks 307-6	7/8	55	743	19			7.35	54	72.0	65	11.0	36	7.65	26	15.5	64	10.9	67	41.5	4	9.80	48
Petty Toole	7/8	55	698	35			7.33	58	94.2	31	9.3	53	6.49	50	17.7	56	11.0	65	34.3	35	11.54	36
Burnett	7/8	55	756	12			7.21	65	97.6	14	8.6	58	5.88	59	17.8	55	12.7	50	32.5	50	10.55	44
Mexican Big Boll	7/8	55	660	47	.320	7	7.43	49	98.4	9	12.2	22	8.15	16	21.7	27	14.8	21	35.9	27	13.24	26
College	27/32	59	744	18			7.48	44	99.2	1	12.8	15	6.41	52	19.3	44	12.9	47	39.8	6	8.29	58
Wannamaker Cleveland	27/32	59	685	41			7.34	56	98.8	4	12.6	18	7.80	22	23.4	16	14.7	22	35.0	33	9.64	49
Trice	27/32	59	562	66			7.46	47	92.0	40	9.2	55	6.12	56	22.0	23	14.9	20	29.4	63	9.09	52
Half and Half	26/32	62	621	56	.402	9	7.70	21	98.0	10	15.2	4	11.90	1	18.0	53	14.1	34	45.7	1	7.86	60
Westex	26/32	62	837	2			7.93	7	92.0	40	11.0	36	6.48	51	19.5	41	11.7	60	36.1	25	8.24	59
Garo Hill	25/32	64	699	34	.465	10	7.76	18	98.8	24	8.1	62	7.11	36	9.9	68	8.7	68	45.0	2	15.53	10
Naked Seed Acala	6/8	65	616	59			7.18	66	94.0	32	2.3	67	1.93	65	15.9	63	13.4	41			0.00	67
King 82	6/8	65	734	23			7.35	54	90.4	47	7.2	63	5.67	62	14.8	66	11.4	61	32.6	48	13.51	24
Mebaken	21/32	67	815	5			7.70	21	92.0	40	1.7	68	1.46	66	16.0	61	13.8	36			1.88	65
G. Nanking	5/8	68	529	69					83.2	59												
Seabrook Tidewater	19/32	69	702	33			7.91	8	93.2	37	10.0	48	9.26	5	15.5	64	14.4	30	39.2	9	9.09	52

SUMMARY AND CONCLUSIONS

Reasons for undertaking this study were to present and list the characters of certain old line varieties some of which, while of no commercial value at the present time, may ultimately become important if new uses arise for any of these fiber properties. These varieties may possess genetic factors which may be in demand at some future date. Seeds keep well in the arid climate and may be preserved for long periods of time.

All data obtained on staple-length, strength index, fiber fineness, moisture regain capacity, maturity index, lint weight, lint index, seed weight, seed index, ginning percentage, and fuzziness are reported in table 7. High, mean, and low values of each character are shown in table 6.

Relationship between characters varied considerably, but the following observations were made:

1. Long-stapled cottons had fine fibers, small bolls, low lint percentage, and a low maturity index.

2. Varieties having a low maturity index and an intermediate staple-index tended to have stronger fibers.

3. Finess increased with staple length, but decreased with increasing maturity and increasing lint percentage.

4. Moisture regain capacity was independent of other fiber characteristics studied; it was, however, significant and substantial in comparing uplands cottons with Egyptian varieties.

The latter had a higher value.

5. Fiber maturity increased with increasing lint percentage, but decreased with increasing fiber length and fineness.

6. Lint weight and lint index, as well as seed weight and seed index, were closely related. With the exception of Half and Half, varieties with a high lint index did not have a high lint percentage. A low seed index was generally associated with a high ginning percentage and vice versa.

7. Fuzziness was not found related to any other fiber characters studied.

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APPENDIX

Definition of Terms Used

1. Staple Length. The average length in inches of the cotton fibers in the sample.
2. Strength Index. A relative value based on the relationship between pounds pull required to break a given sample of lint and the weight of the sample in milligrams.
3. Fiber Fineness. The weight in milligrams of a given number of fibers of known length.
4. Moisture Regain Capacity. The loss in moisture by a sample of cotton upon drying in an oven divided by the oven dry weight.
5. Maturity Index. A measure of the degree of thickening of the fiber cell walls as observed by magnification.
6. Lint Weight. The weight in grams of the lint from a sample of cotton.
7. Lint Index. The weight in grams of the lint from 100 seeds.
8. Seed Weight. The weight in grams of the seeds from a given sample.
9. Seed Index. The weight in grams of 100 seeds.

10. Ginning Percentage. The weight of lint divided by the weight of seed-cotton.

11. Fuzz Percentage. The percentage of short fibers (produced by the outgrowth of epidermal hairs) remaining on the s eed after the lint has been removed.

12. Average Deviation. The average for all deviations from the mean of a series; it is expressed in the same unit of measurement that has been used in recording the items.

13. Arithmetic Mean. The val ue obtained by summing all the individual items and dividing by the total number of items.

14. Correlation. The relationship between two quantities; the mean of the second quantity is said to be a function of the first quantity.

15. Variation. The occurrence of differences among individuals of the same class.

16. Variety. A division of a species; a group of individuals within a species that differ in some minor respect from the rest of the species.

17. Roving. A sample of cotton lint after it has been drawn out and slightly twisted.

18. Convolute. The tendency for some fibers to roll upon themselves or become twisted.

19. Raphe. A seamlike line devoid of fibers located between the two lateral halves of a seed.