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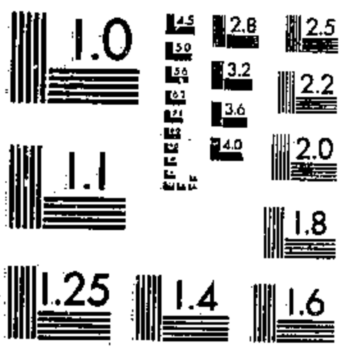

MICROCOPY RESOLUTION TEST CHART
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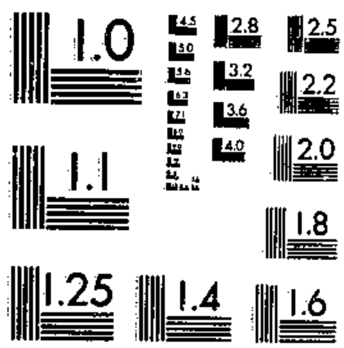

MICROCOPY RESOLUTION TEST CHART
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POSITIONS OF SEEDS AND MOTES IN LOCKS AND LENGTHS OF COTTON FIBERS FROM BOLLS BORNE AT DIFFERENT POSITIONS ON PLANTS AT GREENVILLE, TEX.

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INTRODUCTION

The presence of large numbers of abortive seeds, or motes, in cotton has invited attention to the need for more specific information in regard to the number of motes in different varieties, their positions in the locks, the number of mature seeds in locks, length of fibers on motes and on seeds, and the possible correlation of number of mature seeds in locks and the length of lint.

Preliminary to a more extensive consideration of certain phases of cotton-fiber investigations, studies of variations in some of the seed and fiber characters of 10 varieties and strains of cotton were begun at the United States Cotton Breeding Field Station, Greenville, Tex., in the fall of 1931. Rogers' (Texas) Acala, Indio (California) Acala, Lone Star (D 2–1), Delfos (6102–6112), Mebane, Rowden, Sunshine, Kasch, Kekchi, and Half and Half were selected as representing varieties that are widely grown in the State, with the exception of Kekchi which was included because of its particular type.

METHODS OF PROCEDURE

Three open bolls were collected from different positions from each of 10 normal well-grown plants of 10 varieties and strains. The first boll was taken from the lower, the second from the middle, and the third from the upper fruiting positions of the plant, representing therefore early, midseason, and late bolls, respectively. This method of selecting the bolls gave a total of 10 early, 10 midseason, and 10 late bolls of each variety and strain. The bolls were collected in the bur in order to retain the motes and seeds in their original positions in the locks. Each boll, including the bur, was placed in a separate paper bag marked to show variety, plant number, and position on the plant from which it was removed.

Comparable material was collected from the crops of 1931, 1932, and 1933, at Greenville, making a total of 900 bolls available for this study.

COMBING AND MOUNTING OF FIBERS

The fibers of all seeds from one lock of each boll were combed out and the combings mounted on heavy cardboard with a covering of cellophane for permanent filing. The seeds and motes were numbered consecutively from base to apex of the lock, and their positions in the locks preserved during the process of combing and mounting.

A refinement of the method of combing the fibers described by Cook (*4*)[1] consists of the use of a needle to assist in parting the fibers on each seed carefully along the raphe and opposite side of the seed to cause a minimum breakage of fibers and divide them as evenly as possible into right and left portions. The fibers on both sides were combed out and the finished combing pressed down on a velvet-covered board, as shown in plate 1. Measurements of the length of fibers were recorded for each side of the seed, after which the combing was transferred to the cardboard and placed in a permanent file.

SEEDS

POSITION OF SEEDS IN LOCKS

The positions of seeds in the locks usually are easy to determine because of the normal arrangement in two staggered rows, as shown in plate 2. In a few cases a single seed was found in the middle of the lock—that is, between the two rows of seeds that normally are contained in each lock—but close observation of the position of the raphe during separation of the seeds for combing of the fibers usually indicated to which side of the lock that particular seed belonged. Possibly pressure of the other ovules during formation forced it out of its normal position, and a continuation of that pressure during subsequent growth and development maintained it in the abnormal position. In a majority of such cases observed, the seed was located at the third position in the lock, but two of them were in the fifth position.

The presence of more than 1 or 2 motes in a lock of cotton necessitated increased care in observation of the positions of individual seeds and motes, since the location of the raphe is more difficult to determine on motes than it is on mature seeds.

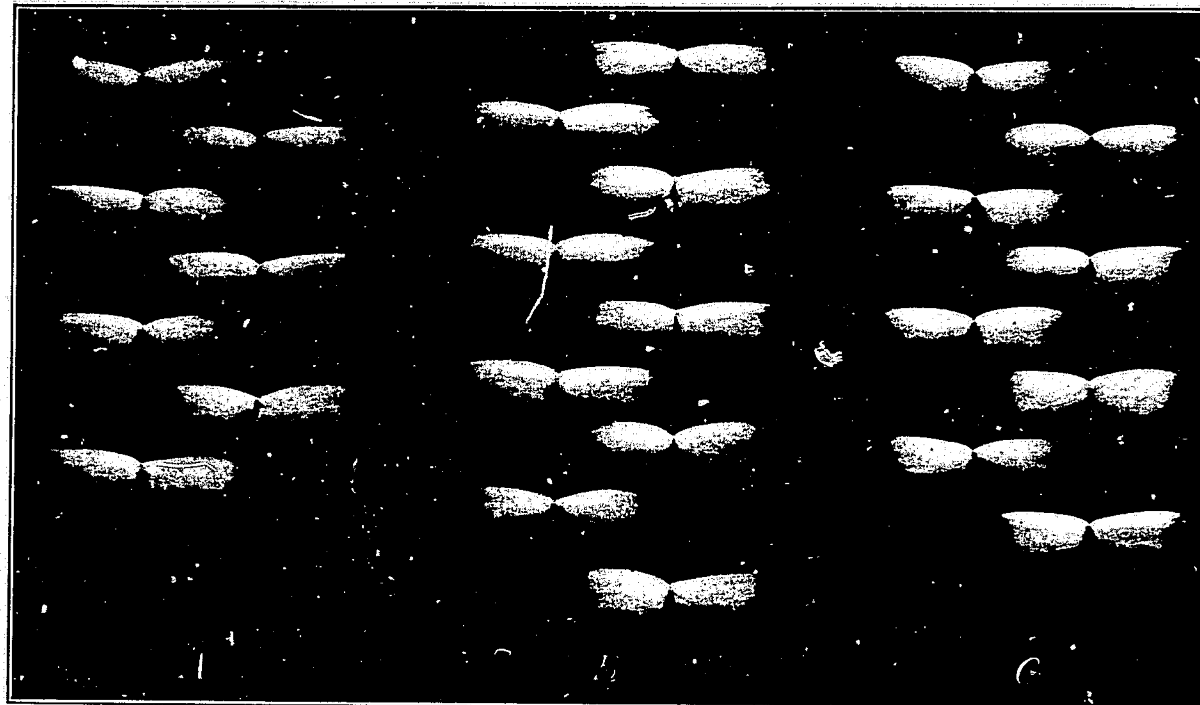
NUMBER OF MATURE SEEDS IN LOCKS

The number of mature seeds and motes vary widely in different locks of cotton. Ordinarily there are from 7 to 9 ovules in each carpel in which a lock is formed, but occasionally there are 10 or more.

Frequency distributions of the number of mature seeds per lock in the varieties included in this study showed that the majority of the locks contained 7, 8, or 9 seeds in 1931 and 1932, and 6, 7, or 8 in 1933. In the 1932 bolls, 30 locks having been tested for each variety, one

[1] Italic numbers in parentheses refer to Literature Cited, p. 12.

PLATE 1



Combings of the fibers on all seeds in one lock from each of three bolls of Delfos (6102-6112) cotton grown in 1931, placed on a velvet-covered board for measurement of the length of lint: *A*, From early boll; *B*, from midseason boll; *C*, from late boll. The combings are arranged in the order in which the seeds occurred in the locks, alternating in columns to represent the two rows of seeds in the lock, with the basal seed, in the first position, at the bottom. An average of the length of lint on both sides of the seed, measured from a common base along the raphe, was used in subsequent calculations as the length of lint on each seed. Note the mote at the first position in the late-season lock. Greenville, Tex. (About one-half natural size.)

Two normal locks of cotton stretched out to show the usual alternate arrangement of seeds from base to apex. Greenville, Tex., 1932. (Natural size.)

midseason lock of Lone Star contained only 3 mature seeds and 7 motes, while another contained 3 seeds and 5 motes. Of locks containing only 4 mature seeds each, there were 3 in 1931, 4 in 1932, and 8 in 1933. Only one lock (Half and Half in 1932) contained as many as 11 seeds, but 13 locks in 1931, 20 in 1932, and 5 in 1933 exhibited 10 mature seeds each.

The greatest number of seeds per lock occurred in early bolls in only a few cases. When 10 locks of a variety were combined, and when the averages for all varieties were considered as a single group, the greatest mean number of seeds was always found in locks of the midseason or late bolls.

The mean number of mature seeds in locks, as shown in table 1, varied from 5.7 in early Kekchi and in Rogers' Acala bolls in 1933 to 8.6 in late Kasch bolls in 1932. The yearly averages ranged from 6.40 in Rogers' Acala in 1933 to 8.33 in Kasch in 1932. With a total population of 90 locks of each variety covering the 3-year period, the lowest mean number of seeds per lock, 6.91, was noted in Rogers' Acala and the highest, 8.07, in Kasch. The average for all varieties decreased from 7.67 in 1931 to 7.63 in 1932 and 7.06 in 1933.

TABLE 1.—*Mean number of seeds per lock in 10 varieties and strains of cotton at Greenville, Tex., 1931–33*

Variety	1931				1932				1933				3-year average (90 locks)
	Early (10 locks)	Midseason (10 locks)	Late (10 locks)	Mean (30 locks)	Early (10 locks)	Midseason (10 locks)	Late (10 locks)	Mean (30 locks)	Early (10 locks)	Midseason (10 locks)	Late (10 locks)	Mean (30 locks)	
Acala (Rogers)	6.8	7.9	6.9	7.20	6.5	7.2	7.7	7.13	5.7	6.3	7.2	6.40	6.91
Acala (Indio)	6.9	7.6	7.5	7.33	7.4	7.9	7.6	7.63	6.4	6.2	7.1	6.57	7.18
Lone Star	7.7	8.0	8.5	8.07	7.6	6.9	7.7	7.40	6.7	7.6	7.4	7.93	7.50
Delfos	8.3	8.0	8.6	8.27	7.3	8.1	7.5	7.63	7.0	7.7	7.6	7.40	7.77
Mebane	8.0	8.0	8.4	8.13	7.5	7.7	7.4	7.53	7.0	7.4	7.5	7.30	7.66
Rowden	7.7	7.9	8.4	8.00	7.9	8.4	8.5	8.27	7.2	7.0	7.5	7.23	7.83
Sunshine	6.9	7.6	6.3	6.93	7.1	7.7	7.1	7.30	6.6	7.2	6.3	6.87	7.03
Kasch	7.9	8.3	7.7	7.97	8.5	7.9	8.6	8.33	7.7	8.3	7.7	7.90	8.07
Kekchi	7.6	7.7	7.3	7.50	6.7	7.0	7.6	7.10	5.7	6.6	7.3	6.53	7.04
Half and Half	6.9	7.4	7.7	7.33	7.6	7.8	8.4	7.93	7.2	7.7	7.2	7.37	7.54
Average	7.40	7.84	7.72	7.67	7.41	7.60	7.81	7.63	6.72	7.14	7.32	7.06	7.46

MOTES

Frequently a number of the ovules abort before maturity of the seeds or of the fibers. For the present study, all ovules that failed to develop into mature seeds, whether the cause of failure could be attributed to imperfect fertilization or to malnutrition of the fertilized ovules, have been considered as motes. There is some divergence of opinion in regard to an appropriate definition of the word "mote." Cook (*3, p. 27*) points out—

> Bolls do not reach normal development during the water-stress period. The seeds do not grow to full size, and many have abortive, shriveled embryos, while the fiber is both shorter and weaker than that of the normally developed bolls.

Hawkins and Serviss (*5*) conclude from studies of the Pima and Acala varieties in Arizona:

> Fiber growth begins at the time of flowering irrespective of fertilization and proceeds rapidly after fertilization but ceases within a few days in unfertilized bolls.

Rea (*11*) states:

> Apparently, motes might be caused by moisture or nutritional deficiencies or they might be caused by imperfect fertilization * * * extreme drought conditions are very conducive to the production of a large number of motes.

Kearney and Harrison (*7*) report that at Sacaton, Ariz.—

> a number of ovules fail to develop, probably because they are defective or because they are not reached by pollen tubes.

Kearney (*6*) also says:

> Fertilization is more nearly complete, however, and the yield of seed and lint is greater, when additional pollen is carried to the stigmas by bees and other insects.

Afzal and Trought (*1*), from a study of three strains of Punjab-American cotton in India, report that—

> all the motes examined showed considerable development of various tissues. Motes must, therefore, be considered as fertilized ovules which have failed to develop into seeds and not as the remains of unfertilized ovules.

POSITION OF MOTES IN LOCKS

The number and percentage of motes at the various positions in locks, given for the 3 stated years in table 2, corroborate Rea's (*10*) statement that "a progressive increase in motes is registered from apex to base." Because of the relatively small number of motes at all positions in the locks, excepting the first one, the figures for all varieties are consolidated.

Of the total of 388 motes found in the 1931 locks, 155, or 39.9 percent, were located at the first position, at the base of the lock. In 1932 and 1933 the percentages of motes in the first positions were 33.0 and 31.1, respectively. The remainder were located in decreasing numbers in the positions from 2 to 11.

When the figures for the 3 years were combined, the percentages of motes in the first positions of early, midseason, and late locks were strikingly uniform, being 34.84, 34.41, and 34.30, respectively.

To the extent that motes represent unfertilized ovules, it is natural that fewer motes would be found near the apex of the lock, as the ovules near the top of the ovary are favored in fertilization, being reached first by the pollen tubes. If the quantity of pollen deposited on the stigmas is scanty, or much of it defective, there would be a correspondingly small chance of the lower ovules being fertilized.

TABLE 2.—*Number and percentage of motes at each position in the lock for all varieties combined for each year, at Greenville, Tex., 1931–33*

Position in lock	1931		1932		1933		3 years combined	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
11	1	0.3	1	0.2			2	0.16
10	4	1.0	14	3.2	3	0.7	21	1.69
9	19	4.9	13	3.0	14	3.3	46	3.69
8	15	3.9	17	3.9	20	4.7	52	4.17
7	17	4.4	22	5.0	29	6.9	68	5.46
6	26	6.7	22	5.0	20	4.7	68	5.46
5	21	5.4	34	7.8	29	6.9	84	6.74
4	34	8.8	46	10.6	48	11.4	128	10.27
3	51	3.1	46	10.6	54	12.8	151	12.12
2	45	11.6	77	17.7	74	17.5	196	15.73
1	155	39.9	144	33.0	131	31.1	430	34.51

NUMBER OF MOTES IN LOCKS

The number of motes that may occur in a lock of cotton varies from none at all to a number equal to the total number of ovules in the carpel, but usually does not exceed 1 or 2. Of the total of 300 locks examined for 1931, 86, or 28.67 percent, were without motes; 106, or 35.33 percent, contained only 1 mote each; 66, or 22 percent, had 2 motes each; and the remaining 14 percent of the locks had from 3 to 5 motes each. The same general relation exists in the bolls for 1932 and 1933.

The mean number of motes per lock ranged from a minimum of 0.3 in midseason Sunshine bolls in 1931 to 2.7 in early Kekchi bolls in 1933, as shown in table 3. Delfos in 1931, and Rowden in the 2 succeeding years, had the smallest annual average number of motes per lock, with 0.60, 0.83, and 0.87, respectively. Kekchi, with 1.77 in 1931 and 2.13 in 1932, and Mebane, with 1.77 in 1933, had the highest mean number of motes per lock. Taking an average of all three positions on the plants for the 3 years, Rowden exhibited the smallest and Kekchi the largest mean number of motes per lock, with 0.97 and 1.88, respectively.

Taking an average of all varieties, the mean number of motes increased from early to late season in 1931 and 1932 and decreased in like order in 1933.

TABLE 3.—*Mean numbers of motes per lock in 10 varieties and strains of cotton at Greenville, Tex., 1931–33*

Variety	1931				1932				1933				3-year average
	Early	Midseason	Late	Mean	Early	Midseason	Late	Mean	Early	Midseason	Late	Mean	
Acala (Rogers)	1.5	1.4	2.1	1.67	2.0	1.5	1.1	1.53	2.4	1.9	0.9	1.73	1.64
Acala (Indio)	.9	1.9	1.5	1.43	.8	1.1	1.5	1.13	1.1	1.7	1.2	1.33	1.30
Lone Star	1.8	1.5	1.2	1.00	1.5	2.0	2.1	2.07	1.8	1.5	1.4	1.67	1.74
Delfos	.4	.7	.7	.60	1.7	1.2	1.4	1.43	1.5	1.5	1.0	1.33	1.12
Mebane	1.5	1.3	1.0	1.27	2.2	1.9	2.1	2.07	1.8	1.9	1.6	1.77	1.70
Rowden	.9	1.8	.9	1.20	1.0	.5	1.0	.83	.7	1.1	.8	.87	.97
Sunshine	.7	.3	1.7	.90	.8	1.0	1.5	1.10	.9	.9	1.2	1.00	1.00
Kasch	1.2	1.1	1.4	1.23	1.0	1.7	1.0	1.23	1.0	1.0	1.3	1.10	1.19
Kekchi	1.3	1.9	2.1	1.77	1.9	2.4	2.1	2.13	2.7	1.7	.8	1.73	1.88
Half and Half	1.0	1.3	1.5	1.27	.5	1.0	1.5	1.00	1.4	1.7	1.8	1.63	1.30
Average	1.12	1.35	1.41	1.29	1.34	1.49	1.53	1.45	1.53	1.49	1.20	1.41	1.38

The lowest percentage of motes per lock to the total number of ovules in the carpel in 1931 was 6.77, found in Delfos, and the highest, 19.06, in Kekchi. In the following 2 years Rowden was low, with 9.16 and 10.70 percent, respectively; and Kekchi, with 23.10 percent, and Rogers' Acala, with 21.31 percent, were highest. For the 3-year period Rowden had the next to the largest number of seeds and the smallest number of motes, giving the lowest percentage of motes, 10.98. Rogers' Acala had the smallest number of seeds and the highest percentage of motes, 22.09. Kekchi, with the largest number of motes, 169, had next to the highest percentage of motes, 21.05.

Delfos had the smallest total number of motes of any variety for the 3 years, with only 18 in 1931, and Kekchi the largest, with

64 in 1932. In the latter year Mebane and Lone Star had 62 each. For the 3-year total, Rowden and Sunshine had the smallest numbers, with 87 and 90, respectively, and Kekchi again showed the largest number, with 169.

The mean percentage of motes for all varieties increased from 14.42 in 1931 to 16.01 in 1932 and 16.61 in 1933.

The total number of seeds and motes and the percentage of motes to the total number of ovules in the locks for each variety for the 3 years are shown in table 4.

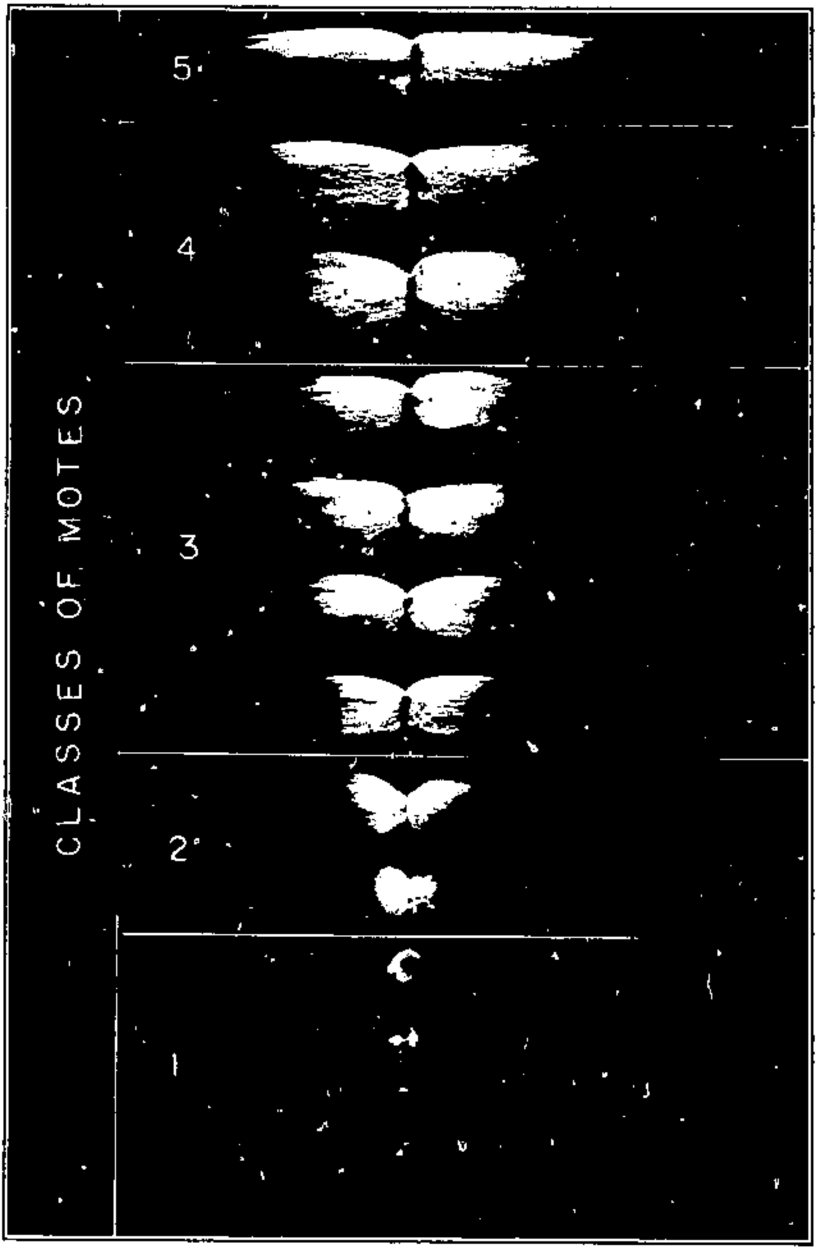
TABLE 4.—*Total number of motes and of seeds, and percentages of motes to total numbers of ovules in the locks for 3 years, separately and combined, Greenville, Tex., 1931–33*

Variety	1931			1932		
	Number of seeds	Number of motes	Percentage of motes to total number of ovules	Number of seeds	Number of motes	Percentage of motes to total number of ovules
Acala (Rogers)	216	50	18.80	214	46	17.69
Acala (Indio)	220	43	16.35	229	34	12.93
Lone Star	242	48	16.55	222	62	21.83
Delfos	248	18	6.77	229	43	15.81
Mebane	244	38	13.48	226	62	21.53
Rowden	240	36	13.04	248	25	9.16
Sunshine	208	27	11.49	219	33	13.10
Kasch	239	37	13.41	250	37	12.89
Kekchi	225	53	19.06	213	64	23.10
Half and Half	220	38	14.73	238	30	11.19
All varieties	2,302	388	14.42	2,288	436	16.01

Variety	1933			3-year total		
	Number of seeds	Number of motes	Percentage of motes to total number of ovules	Number of seeds	Number of motes	Percentage of motes to total number of ovules
Acala (Rogers)	192	52	21.31	622	148	22.09
Acala (Indio)	197	40	16.88	646	117	15.33
Lone Star	211	47	18.22	675	157	18.87
Delfos	222	40	15.27	699	101	12.62
Mebane	219	53	19.49	689	153	18.17
Rowden	217	26	10.70	705	87	10.98
Sunshine	206	30	12.71	633	90	12.46
Kasch	237	33	12.22	726	107	12.85
Kekchi	196	52	20.97	634	169	21.05
Half and Half	221	49	18.15	679	117	14.70
All varieties	2,118	422	16.61	6,708	1,246	15.67

CLASSES OF MOTES

For this study the motes have been classified according to the degree of maturity of the seeds as indicated by their relative sizes and their length of lint in comparison with the remainder of those in the lock, keeping in mind the generally recognized differences in length of lint between standard varieties. There are no sharp demarcations between these classes but all overlap to a greater or less degree. This holds true for fibers on mature seeds as well as on motes.



Classes of motes, as picked out of Lone Star cotton. Greenville, Tex. 1932. (Natural size.)

Fibers longer on right side of a Rowden seed than on left side. Note the small group of long fibers on the upper left side of seed. An exaggerated condition similar to this has been termed "butterfly" cotton. Butterfly cotton has been largely eliminated in well-bred strains. Greenville, Tex. 1932. × 2½.

The five classes into which the motes have been grouped are illustrated in plate 3. The first division is represented by those with fibers up to about one-eighth inch in length, the second with fibers from one-eighth to one-fourth inch, the third from one-fourth to one-half inch, the fourth one-half to five-eighths inch, and the fifth longer than five-eighths inch but with the seed still definitely immature.

This classification is not entirely satisfactory because of the lack of sharp lines of demarcation between the classes. Since the problem is a biological one and definite differences between classes could not be expected, the grouping arrangement serves very well the purposes of this study. In many cases, especially in the Delfos variety, the fibers on a given mote are long enough to belong to the second class, while the aborted seed is so small as to suggest that it belongs in the first class. Occasionally the situation is reversed, and the seed is too large to be placed in the class in which the length of the fibers should place the mote.

When segregated according to this classification, a large majority of the motes fall into class 1, a smaller number into class 2, and the remainder into the other three classes. The percentages in the first class were 59.5 in 1931, 56.9 in 1932, and 69.4 in 1933. Those in the second class ranged from 20.6 in 1933 to 25.5 in 1931. Averaging the results for the 3 years, 61.96 percent were in the first class, 23.12 percent in the second, and the remaining 14.92 percent scattered through the other three classes.

The numbers and percentages of motes in each of the five classes for the 3 years are shown in table 5.

TABLE 5.—*Number and percentage of motes in each of the 5 classes, Greenville, Tex., 1931–33*

Class	1931		1932		1933		3 years combined	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	231	59.53	248	56.88	293	69.43	772	61.96
2	99	25.52	102	23.39	87	20.62	288	23.12
3	17	4.38	20	4.59	15	3.55	52	4.17
4	13	3.35	28	6.42	9	2.13	50	4.01
5	28	7.22	38	8.72	18	4.27	84	6.74

LENGTH OF LINT

Differences in length of lint occur not only within a variety, strain, or plant, but have been observed within the bolls and locks and even on individual seeds to such an extent that the length of the fibers combed to either side of the raphe on a single seed may be as much as three-sixteenths of an inch longer or shorter than those on the other side. An example from the Rowden variety is shown in plate 4, in which the fibers combed to the right are considerably longer than those combed to the left side of the seed.

Particularly noticeable in the Mebane bolls for 1932 were the comparatively small groups of fibers near the large end of some seeds that were abruptly longer than the other fibers on the same seeds. Similar groups of fibers are found occasionally in other varieties.

Occasionally all of the combings made from a plant were definitely shorter or longer than those from other plants of the same variety, and when the difference appeared to be too great, the plant was designated a rogue and discarded.

On the seeds that were located between two rows that normally are contained in each lock, the fibers usually were shorter than those on the seeds immediately surrounding them.

In some cases the mean length of lint of a variety varied between different parts of the season as much as one-sixteenth of an inch in 1931, one thirty-second of an inch in 1932, and one-eighth of an inch in 1933.

The mean lengths of lint in early, midseason, and late locks of all varieties examined for the 3 years are shown in table 6, and are illustrated graphically in figure 1.

TABLE 6.—*Mean lengths of lint, in thirty-seconds of an inch, in 10 varieties and strains of cotton at Greenville, Tex., 1931–33*

Variety	1931				1932			
	Early (10 locks)	Mid-season (10 locks)	Late (10 locks)	Mean (30 locks)	Early (10 locks)	Mid-season (10 locks)	Late (10 locks)	Mean (30 locks)
Acala (Rogers)	35.0	34.8	37.1	35.6	34.8	33.3	34.9	34.3
Acala (Indio)	34.1	34.1	35.9	34.7	34.8	33.0	33.7	34.0
Lone Star	31.1	29.9	31.3	30.8	30.8	30.7	31.8	31.1
Delfos	38.9	37.7	37.4	38.0	39.6	39.1	38.1	38.9
Mebane	30.8	30.7	31.5	31.0	31.3	31.0	31.6	31.3
Rowden	32.8	31.7	32.0	32.2	31.5	31.7	30.7	31.3
Sunshine	29.9	29.5	29.7	29.7	30.5	30.0	29.4	30.0
Kasch	30.9	30.3	32.9	31.4	32.0	31.7	30.7	31.6
Kekchi	37.9	38.3	38.3	38.2	37.5	36.9	36.8	37.1
Half and Half	23.9	23.3	22.7	23.3	23.5	23.7	22.4	23.2

Variety	1933				3 years combined			
	Early (10 locks)	Mid-season (10 locks)	Late (10 locks)	Mean (30 locks)	Early (30 locks)	Mid-season (30 locks)	Late (30 locks)	Mean (90 locks)
Acala (Rogers)	33.0	37.9	35.9	35.6	34.2	35.3	36.0	35.2
Acala (Indio)	36.7	38.0	36.1	36.9	35.2	35.2	35.2	35.2
Lone Star	31.7	34.5	31.7	32.6	31.2	31.7	31.6	31.5
Delfos	34.7	39.1	38.2	37.3	37.7	38.6	37.9	38.1
Mebane	31.6	33.8	32.5	32.6	31.2	31.8	31.9	31.6
Rowden	29.0	30.6	31.0	30.6	31.1	31.3	31.5	31.3
Sunshine	29.2	29.8	32.3	30.4	29.9	29.8	30.5	30.1
Kasch	28.8	33.8	34.3	32.3	30.0	31.9	32.6	31.7
Kekchi	36.8	40.8	39.7	39.1	37.4	38.7	38.3	38.1
Half and Half	23.0	26.2	25.8	25.0	23.5	24.4	23.6	23.8

From studies on Pima Egyptian cotton in Arizona in 1923, Kearney and Harrison (*8*) concluded that—

> bolls borne on the lower fruiting branches, constituting the so-called "bottom crop", produced shorter fiber than bolls that are situated higher on the plant.

In 1931 the lint in the majority of midseason locks was shorter than in the early locks borne on the lower fruiting branches and the late ones borne on fruiting branches near the top of the plants. In 1932 the midseason locks were with two exceptions shorter than those from the early bolls. In 1933, in all cases midseason locks were longer than early locks, and in seven cases were longer than late ones. Combined for the 3 years, Indio Acala exhibited the same length from early to late locks; all others increased in length from early to late. However, in Lone Star, Delfos, Kekchi, and Half and Half the midseason locks were slightly longer than either the early or late locks.

LENGTH OF LINT ON SEEDS AT GIVEN POSITIONS IN THE LOCK

The lint on the first and last seeds of the locks often was observed to be shorter than that on intervening seeds. Armstrong and Bennett (*2*) have shown by the sorter method of determining the length

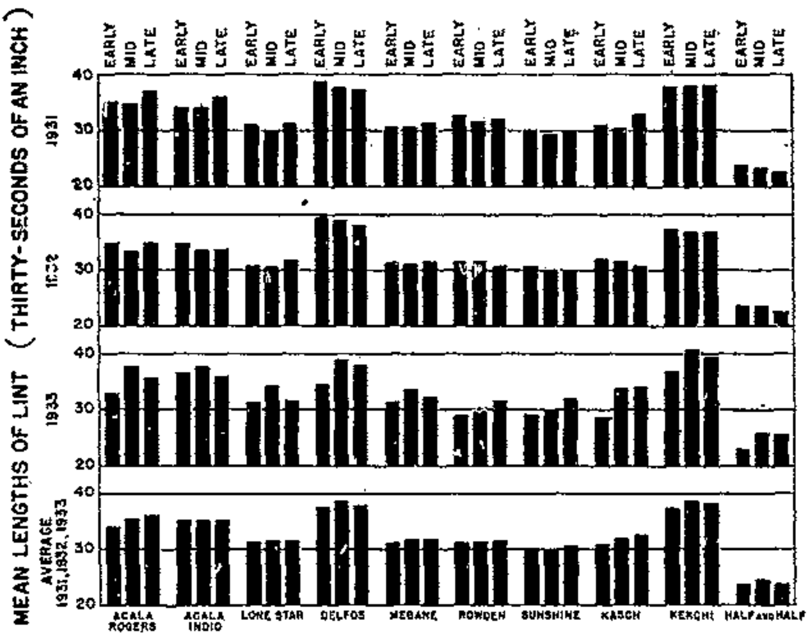


FIGURE 1.—The mean length of lint in early, midseason, and late locks of 10 varieties and strains of cotton for the years 1931, 1932, and 1933. Greenville, Tex. (Scale: 1 inch = 1/32 inch.)

of lint that in a lock of Super-Seven cotton the modal length on each seed increased from base to apex from seed no. 1 to seed no. 6 and then showed a slight decline. Moore (*9*) stated that, in four strains of American upland cotton—

> There were no significant differences in the staple length on seeds within the same lock; therefore the staple length on the middle seed was similar to the average of the lock.

When the 10 locks of early, midseason, or late bolls of each variety covered by this study were considered as one array, the greatest mean lengths were found to occur indiscriminately at any of the positions in the lock. Combining all varieties for all 3 years as one group, the mean length of lint increase. 'rom 32.11/32 inch at the first position to 32.79/32 inch at the third, remained very nearly the same from the third to the seventh positions, inclusive, and then decreased to 30.44/32 inch at the eleventh position. These variations of mean lengths at the different positions in the lock are shown in table 7, and are illustrated graphically in figure 2.

TABLE 7.—*Mean length of lint at given positions in the lock in 10 varieties and strains of cotton for a period of 3 years when considered as one array, Greenville, Tex.*

Position of seed in lock	Seeds on which length of lint was determined	Mean length of lint	Position of seed in lock	Seeds on which length of lint was determined	Mean length of lint
	Number	*1/32 inch*		*Number*	*1/32 inch*
11	25	30.44	4	769	32.77
10	216	31.25	3	749	32.79
9	522	31.99	2	705	32.55
8	780	32.57	1	468	32.11
7	826	32.83			
6	832	32.84	Mean		32.59
5	816	32.86			

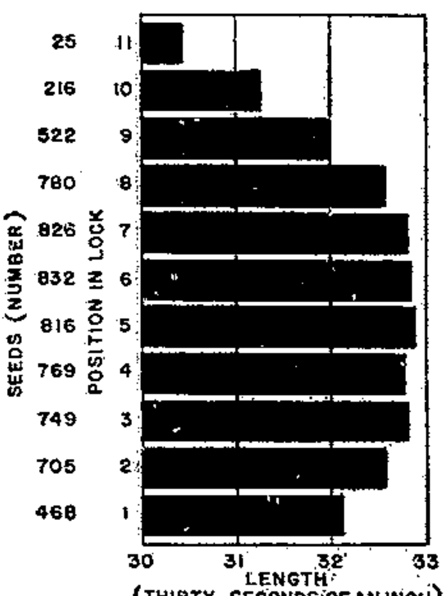


FIGURE 2.—The mean length of lint, according to position in the lock, in 10 varieties and strains of cotton, for the years 1931, 1932, and 1933 combined as one array. Greenville, Tex. (Scale: 1 inch=1/32-inch.)

CORRELATION OF NUMBERS OF SEEDS PER LOCK AND LENGTH OF LINT

In some locks with comparatively small numbers of seeds, the lint was considerably longer than in other locks of the same variety that contained larger numbers of seeds. Grouping all varieties together, the mean numbers of seeds per lock decreased from 7.67 in 1931 to 7.63 in 1932 and to 7.06 in 1933, while the mean length of lint for each year increased from 32.5/32 inch in 1931, to 32.6/32 inch in 1932, and 33.2/32 inch in 1933.

In order to evaluate the possible association of few seeds with long lint or many seeds with short lint in individual locks of cotton, correlation coefficients were calculated separately and collectively for early, midseason, and late locks of each variety for each of the 3 years. A positive correlation is indicated when an increase in length of lint is associated with larger numbers of seeds per lock, and a negative correlation is found when an increase in length of lint is associated with a decrease in numbers of seeds per lock. These calculated values of r are shown in table 8.

TABLE 8.—*Calculated values of "r" (correlation coefficient), furnishing a measure for the tendency of locks of cotton with few seeds to produce fibers of greater length than are produced by locks having large numbers of mature seeds, Greenville, Tex., 1931–33*

Variety	1931			1932		
	Early (10 locks)	Mid-season (10 locks)	Late (10 locks)	Early (10 locks)	Mid-season (10 locks)	Late (10 locks)
Acala (Rogers)	−0.229	0.389	−0.513	−0.097	−0.209	−0.409
Acala (Indio)	−.075	.434	.611	[1] −.761	−.343	[1] −.704
Lone Star	.126	−.011	.247	−.352	.334	−.170
Delfos	.161	[2] −.782	.155	.592	.094	.244
Mebane	.170	−.075	−.059	−.445	−.408	[1] −.750
Rowden	−.369	−.329	−.081	−.158	.217	−.145
Sunshine	.131	−.463	−.108	−.010	−.108	−.312
Kasch	−.185	.270	−.494	[2] −.802	−.281	−.262
Kekchi	−.357	−.138	−.361	−.293	.371	.355
Half and Half	−.259	−.508	−.574	−.048	−.191	.266
All varieties taken as 1 group	.130	.049	−.067	−.020	−.017	[1] −.218

Variety	1933			Early, midseason, and late combined			
	Early (10 locks)	Mid-season (10 locks)	Late (10 locks)	1931 (30 locks)	1932 (30 locks)	1933 (30 locks)	1931, 1932, and 1933 (90 locks)
Acala (Rogers)	−0.044	0.066	[1] −0.741	−0.215	−0.180	0.008	−0.120
Acala (Indio)	−.587	−.144	−.071	.359	[2] −.620	−.356	[2] −.350
Lone Star	−.467	−.368	.005	.134	.059	−.290	−.110
Delfos	.484	.174	.495	−.107	.319	[2] .471	[2] .295
Mebane	−.280	−.328	−.580	.058	[2] −.545	−.311	[2] −.330
Rowden	.533	−.587	−.175	−.325	−.063	−.082	−.001
Sunshine	.082	−.002	−.334	−.111	−.166	−.094	−.122
Kasch	.138	.364	[1] −.710	−.219	[1] −.404	−.045	−.168
Kekchi	.050	−.205	−.038	−.304	.068	.195	−.043
Half and Half	−.049	−.407	.464	[2] −.539	−.084	.013	−.175
All varieties taken as 1 group	[2] −.286	[1] −.249	−.076	.020	[2] −.152	[2] −.150	[2] −.109

[1] Significant.
[2] Highly significant.

There was considerable variation between the values of *r* as calculated for the separate groups in each season for each variety, possibly due in part to the small populations of only 10 locks. According to a table by Wallace and Snedecor (*12*), only 7 of these 90 calculated values of *r* may be considered significant. No consistent differences were shown between early, midseason, and late locks.

Combining the figures for each variety but considering each year separately, columns 10, 11, and 12 of table 8 show that the value of *r* for Kasch in 1932 is significant, and the values for Half and Half in 1931, Indio Acala and Mebane in 1932, and Delfos in 1933 are highly significant. Taking all varieties together, which gives populations of 300 locks for each year, the value of 0.020 for 1931 is not significant, but −0.152 for 1932 and −0.150 for 1933 are highly significant.

Considering the 3 years' data as a single group, a population of 90 locks for each variety, Delfos, with an *r* value of 0.295, is the only one that shows a positive, highly significant association of greater lint length with larger numbers of seeds per lock. The values for all other varieties are negative, of which Indio Acala and Mebane are highly significant. These data indicate that, at Greenville, Tex., there is a definite tendency, in 9 of the 10 varieties and strains examined, for locks of cotton with few seeds to produce fibers of greater length than are produced by locks having large numbers of mature seeds.

Carrying the calculations one step further, the total population of 900 locks for all varieties for all 3 years gives a value of −0.109, which may be considered as being highly significant.

CONCLUSIONS

When all ovules in a carpel develop into mature seeds the lock contains no motes, but if one or more of the ovules abort before development is complete the number of mature seeds in the lock is thereby reduced. Reduction of the number of mature seeds per lock from the total number of ovules in the carpel is inversely proportional to the increase in number of motes.

Since approximately one-third of the motes found in the cotton studies were located at the base of the lock, and the remainder in decreasing numbers toward the apex, it may be assumed that the causes of abortion are more active near the base of the lock.

The mean length of lint for each variety fluctuated from season to season, but an increase in mean length was recorded from early- to late-season bolls for 9 of the 10 varieties and strains.

In a single lock of cotton it is possible for the seed with the longest fibers to occur at any position in the lock. Evidence from a total population of 900 locks, covering three crop seasons, indicate that as a rule the shortest fibers occur on seeds at the apex of the lock, longer fibers on seeds at the base, and the longest fibers on seeds in the central portion of the lock.

While variation occurred within these varieties from year to year, at Greenville, Tex., there was a definite tendency for locks of cotton with few seeds to produce fibers of greater length than are produced by locks having large numbers of mature seeds. It is probable that the actual cause of the tendency to production of longer fiber in locks with fewer seeds is a nutritional one.

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