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**FACTORS AFFECTING THE PERFORMANCE  
OF MECHANICAL COTTON HARVESTERS  
(STRIPPER TYPE), EXTRACTORS  
AND CLEANERS**

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Increasing interest has been shown by cotton growers of the High Plains area in the use of tractor-mounted cotton stripping machines during the past five years. Several concerns are now building two-row tractor mounted machines for the commercial trade. The performance of the stripper type cotton harvester is influenced by a number of factors.

Tests to determine the various factors that affect the performance and efficiency of the mechanical cotton stripper have been conducted by the Texas Agricultural Experiment Station for a number of years. Many commonly grown varieties, selections and strains were tested for their varietal reaction to machine stripping, extracting and cleaning in an effort to obtain a high quality cotton.

Results of tests covering a seven-year period, 1939-1945, are reported in this bulletin.

The performance or efficiency of the stripper harvester varied with the seasonal conditions existing from year to year, between varieties, and between locations. The average efficiency of the Texas Station Stripper at Lubbock for the seven-year period was 96.4 percent, while at College Station it harvested 89.0 percent of the cotton on the plants at harvest time. At College Station there was a difference of 9.3 percent in machine performance between varieties, while at Lubbock the difference between the best and poorest varieties was 6.8 percent.

Field losses in terms of lint cotton varied with the performance of the machine and the suitability of the variety for machine-stripping. At College Station the average lint lost per acre was 19.2 pounds (1945 data excluded), while at Lubbock the average lost was 8.4 pounds per acre (1942 data excluded).

Tall, branchy, wide spreading plants materially affected the performance of the machine causing severe losses while small, short limbed plants reduced the field losses.

Varietal characteristics, such as, stormproofness, size of plant and fluffiness of the locks are important factors that influence machine performance and field losses.

Stormproofness and fluffiness of the lock also affect the performance of extracting machines and the loss of cotton with the burs.

There was no significant difference in the percentage of burs and waste removed from machine-stripped cotton and hand-snapped cotton.

At College Station hand-snapped and machine-stripped cotton averaged approximately  $1\frac{1}{2}$  grades lower than hand-picked cotton, while at Lubbock the difference was slightly less than one grade. There was only .2 of a grade difference in hand-snapped and machine-stripped at each of the locations.

There was no significant difference in the average staple length for the methods of harvesting at the two locations.

Characteristics, such as the degree of spread of the boll sections, the pounds pull required to remove the boll; the length and diameter of the boll peduncle; and the inter-seed fiber drag apparently had no significant affect on the performance of the machine units.

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## FACTORS AFFECTING THE PERFORMANCE OF MECHANICAL COTTON HARVESTERS (STRIPPER TYPE), EXTRACTORS AND CLEANERS

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When the study of mechanical harvesting of cotton was begun by the Texas Agricultural Experiment Station in 1930, interest of both the cotton grower and the machine manufacturer was high. This was particularly true for the cotton farmer of the High Plains area of Texas.

In 1931, one manufacturer made about 500 one-row horse-drawn cotton strippers, but the depression, with all of its accompanying ills, caused the cotton grower to use the great supply of low-cost labor that was available. Interest was not revived in mechanical harvesting until there was a shortage of labor due to war demands. In 1943 the C. E. Morris Company\* of Dallas, Texas, manufactured and sold 35 two-row tractor mounted strippers using the principles developed in this study. In 1944 at least four different concerns manufactured approximately 325 two-row integral mounted tractor operated cotton strippers. In 1945 the number of strippers manufactured rose to approximately 1500. Approximately 300 mechanical cotton picking machines were available for the 1945 harvest.

During all these periods of fluctuating interest, studies on the development of a cotton harvester of the stripper type, an extractor and a cleaner were continued with the thought that interest would develop with the need. Efforts to develop new strains of cotton better suited to mechanical harvesting were continued at both College Station and Lubbock.

This bulletin reports data on the mechanical harvesting of cotton and the breeding and testing of new strains for the period 1939-1945.

### Equipment Used

The original experimental model of the Texas Station Cotton Harvester was constructed and tested in 1930. Changes and improvements made up to and including 1938 are listed and described in Texas Station Bulletins 452, 511, and 580. During the seven-year period, 1939-1945, a number of improvements were made by the Texas Station in both the stripper unit and the extractor unit, (Figures 1 and 2).

\*Went out of business in 1944.

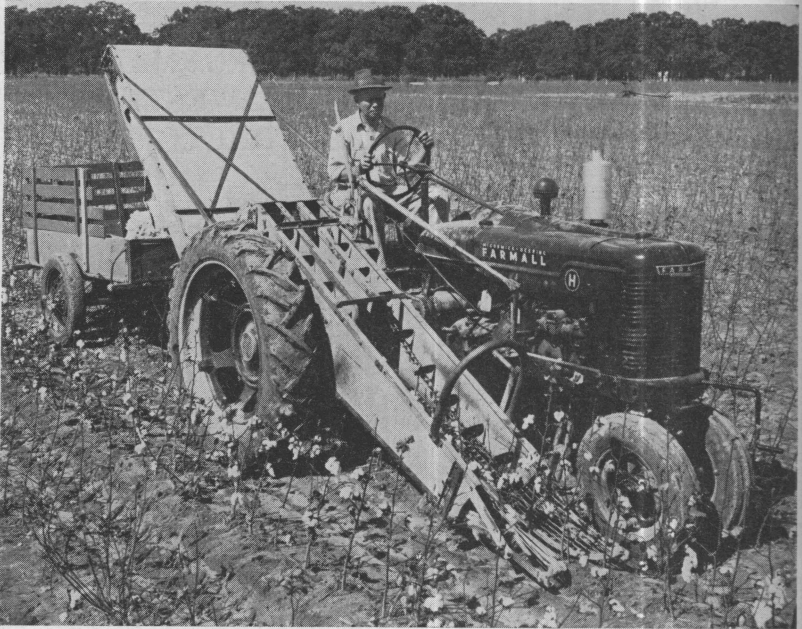


Figure 1. Front view of tractor mounted experimental stripper-harvester unit developed by the Texas Agricultural Experiment Station.



Figure 2. Rear view showing tractor-mounted extractor unit. Used in combination with the stripper-harvester.

*Improvements in the Stripper Unit:* An outstanding improvement made in 1939 was that of installing perforated sheet iron of new design in the conveyor troughs (Figure 3). The perforations were rectangular,  $\frac{1}{2}$  inch wide and  $4\frac{3}{8}$  inches long. These rectangular perforations extended across the bottom of the conveyor at an angle of about 30 degrees. The perforation permitted dirt, trash and some bur sections to be screened out as the cotton was conveyed back to the extractor.

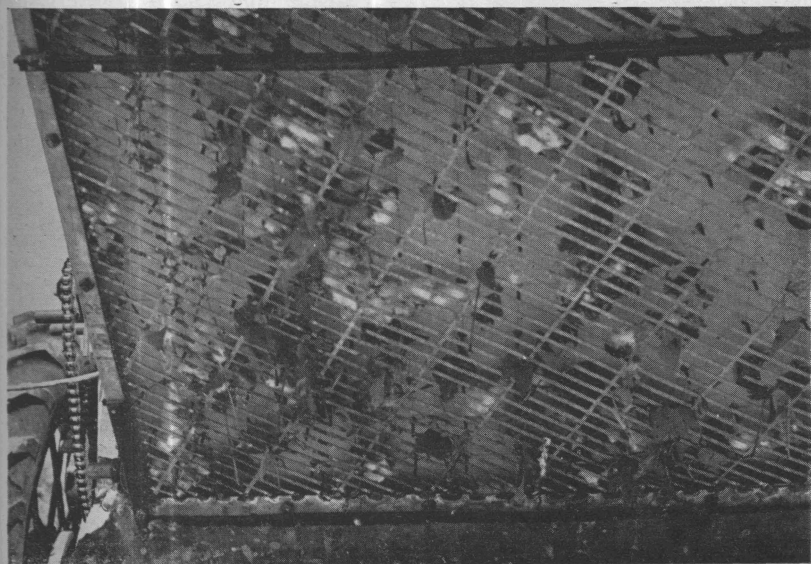


Figure 3. Perforated sheet iron designed and used to screen out green leaves and trash in conveyor troughs of stripper, cross conveyor of extractor and extractor elevator.

In 1940, a pair of right- and left-hand tapered spiral augers were designed, built, and tested to determine the amount of green leaf removed from stripped cotton (Figure 4). It was planned to substitute these augers for the conveyor chain used in elevating the cotton from the stripper unit to the extractor unit. In 1943, the C. E. Morris Company adapted this type of conveyor for their two-row tractor mounted cotton stripper now being made by C. T. Boone.

During the 10-year period, 1930-1940, the Texas Station Cotton Harvester had been used on an F-20 Farmall tractor equipped with steel wheels. As this model has been superseded by a newer design, Model H Farmall, equipped with pneumatic tires, it was necessary in 1941 to completely rebuild the harvester unit. The machine was made 6 inches narrower and 20 inches shorter. The method of attaching the harvester to the tractor was completely changed. The pick-up fingers were redesigned to fit the narrower machine. Many other details, such as bearings, arrangement of gears, universal joints and shafting, were rearranged.

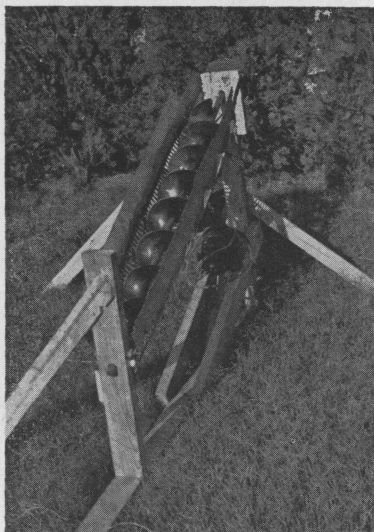


Figure 4. Tapered spiral auger designed to convey the cotton in the stripper-harvester unit being tested to determine effects of angles and percentage of green leaves that could be screened out.

center and to an elevator which delivered the extracted cotton to a trailer. The method of driving the extractor was changed from the power take-off to the pulley, thereby eliminating a set of bevel gears on the drawbar of the tractor. The extractor drive was moved from the slow moving saw shaft to the high speed doffer shaft. This reduced the shock in starting the unit and there was less change in speed of the extractor when there was a change in tractor speed.

In an effort to screen out as much trash as possible a new elevator was constructed in 1940. Harness rivets  $1\frac{1}{2}$  inches long were fastened to a woven cotton canvas belt 40 inches wide. The rivets were spaced 3 inches apart in rows spaced 3 inches. This arrangement rolled the cotton and was not satisfactory. They were later changed to form a diamond pattern which kept the locks of cotton spread and permitted the loss of more leaves and trash. There was a tendency for cotton to work under the edge of the belt and collect there, making frequent inspections and cleaning necessary. This trouble was remedied by placing a deflector shield just under the doffer to deflect the cotton further in toward the center of the belt. Figure 5 shows a cross sectional view of the extractor as used from 1941 to 1945.

*Vertical Cleaner:* The Texas Station vertical cleaner described in Texas Station Bulletin 511 was used to clean the seed cotton obtained in all the harvesting tests for the period 1939-1945.

Many different arrangements of devices to support and permit horizontal movement of the right stripper roll were tried during the time the Texas Station Cotton Stripper was being developed, but none of these devices had proved entirely satisfactory. In 1944 new bearings and supports were made for the front end of the stripping rolls. The movable roll was supported by a parallel linkage arrangement which proved to be very satisfactory.

*Improvements in the Extractor Unit:* Several changes were made in the Texas Station Extractor for the 1939 harvest. The stationary and oscillating fingers were curved upward at the free end next to the extractor saw. The bars to which the fingers were attached were removed farther away from the saw to give more capacity to the "roll-box". A new elevator having right- and left-hand auger flights was made and attached to the rear of the extractor. These flights conveyed the cotton to the



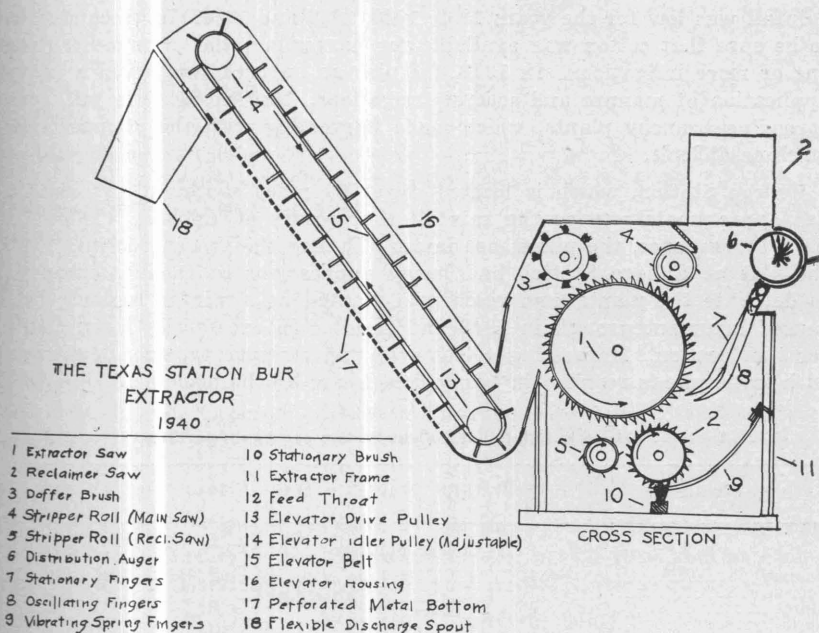


Figure 5. Cross-sectional view of extractor unit as used from 1941 to 1945.

### Varieties Tested

During the seven-year period, 1939-1945, 125 varieties, crosses and strains of cotton were tested to determine the varietal characteristics required for efficient performance of the stripper type cotton harvester. Data also were obtained on varietal characteristics that affected the performance of cotton extracting and cleaning equipment. Of the 125 varieties, 79 were tested at College Station and 46 at Lubbock. Many of the varieties did not have characteristics suitable for efficient machine stripping and they were tested for only one year. Other varieties were tested two or more years before more promising varieties were substituted for them. Complete data are shown for only 17 varieties at College Station and 14 varieties at Lubbock.

In addition to the 125 varieties for which data were obtained, practically as many progenies of crosses were tested to determine if they had characteristics suitable for the stripper type harvester.

### Seasonal Conditions and Rainfall

The amount of rainfall and the moisture in the soil during the entire growing season has considerable influence on the size of the plant at harvest. Low rainfall and a deficiency of soil moisture, a periodic occurrence at Lubbock, results in small plants. Table 1 shows that, at Lubbock,

rainfall was low for the years 1939, 1940, 1943 and 1945. In these studies, to be sure that cotton was available for harvesting, the plats were given one or more irrigations. In 1942, the plat at Lubbock was given a heavy application of manure and several irrigations. This resulted in tall, wide spreading branchy plants, which made harvesting with the stripper type machine difficult.

College Station, which is located some 500 miles southeast of Lubbock, has approximately twice the rainfall that occurs at Lubbock (Table 1). As a consequence, the plants are larger. During the years 1943 and 1944, the plat at College Station had heavy applications of calcium cyanamid to defoliate the plants, and vetch was planted as a winter legume. This caused luxuriant growth in 1945 and resulted in excessively large plants for the location. Harvesting cotton with the stripper type machine from such large plants resulted in heavy field losses by the machine.

Table 1. Monthly Rainfall at College Station and Lubbock, 1939-1945

Month	1939	1940	1941	1942	1943	1944	1945
College Station							
January	4.44	1.00	1.55	.56	2.98	6.97	2.83
February	5.36	4.25	3.64	1.15	.18	4.18	2.66
March	.98	.92	6.63	1.27	2.17	3.96	2.87
April	.93	4.20	1.91	7.79	.67	.30	3.02
May	6.41	4.46	3.06	3.91	7.04	10.70	1.63
June	1.79	8.97	6.39	5.36	1.76	1.52	3.76
July	1.96	3.55	5.49	2.58	5.66	.95	2.64
August	.96	.87	2.76	3.05	.50	5.82	8.11
September	1.22	1.89	2.67	6.17	3.14	2.84	1.70
October	2.26	2.26	6.75	2.05	.77	.15	3.66
November	3.05	8.27	1.61	5.18	2.44	8.89	.27
December	5.10	8.38	2.12	2.32	3.19	7.26	1.39
Total	34.46	49.02	44.58	41.39	30.50	53.54	34.54
Lubbock							
January	2.45	.23	.55	.04	.04	1.28	.69
February	.19	1.97	.61	.18	.02	1.36	.39
March	.09	T	3.56	.51	.25	1.09	.10
April	.28	1.84	2.23	3.25	.53	.84	.46
May	1.82	1.74	12.69	.35	2.71	3.03	.46
June	.67	2.06	4.13	1.74	2.37	1.75	.36
July	1.73	T	3.68	2.58	3.17	2.93	3.08
August	2.75	1.57	1.85	4.97	.00	2.37	2.17
September	.01	.73	4.47	7.61	1.16	3.73	2.22
October	.94	1.07	5.89	3.39	.10	.80	2.26
November	.18	2.35	.17	.01	.62	1.72	.27
December	.60	.20	.72	2.70	1.87	1.64	.32
Total	11.71	13.76	40.55	27.33	12.84	22.54	12.78

### Date of Harvest

In these studies an effort was made to harvest as early as the condition of the cotton would permit. Table 2 shows that at College Station the average date of harvest was September 14, with the exception of 1945. This delay in 1945 was due to the late delivery of a tractor on which to mount the harvester. Table 2 also shows that the average date of harvest at Lubbock was November 14, with the exception of 1943 when the harvest

was made October 19. This early harvest was possible because defoliant was applied to the mature cotton the last week of September. When the leaves were removed from the plants all the well matured bolls opened. It is noted that the date of harvest at Lubbock is 60 days later than at College Station.

Harvesting at College Station was done at a time when the plants were usually in full foliage while at Lubbock harvesting was done soon after the first killing frost.

Table 2. Date of Harvest at College Station and Lubbock

Location	Date						
	1939	1940	1941	1942	1943	1944	1945
College Station.....	Sept. 4	Sept. 11	Sept. 30	Sept. 16	Sept. 10	Sept. 14	Oct. 11
Lubbock.....	Nov. 7	Nov. 13	Nov. 19	Nov. 26	Oct. 19	Nov. 8	.....

### Performance of Texas Station Cotton Harvester (Stripper)

Data showing the performance or the percentage of cotton harvested by the Texas Station Cotton Harvester for the period 1939-1945 at College Station and Lubbock are given in Tables 3 and 8.

*Performance at College Station:* A study of Table 3 reveals that the performance or efficiency of the machine varied from year to year and for the various varieties harvested each year. The highest percentage of cotton harvested was in 1939 and 1944 when it totaled 94.4 percent. In both these years, low rainfall during June and July retarded the growth of the plants and also caused extensive shedding of foliage. In 1945, however, ample rainfall during the early growing season caused the development of large branchy plants (Figure 6). This condition resulted



Figure 6. Left—showing height of plants at College Station in 1945. Right—showing number and length of sprouts on plants at time of harvest.

in very poor machine harvesting. The average efficiency for six varieties was 62.2 percent, which was the poorest performance obtained with the machine during the entire period of 15 years.

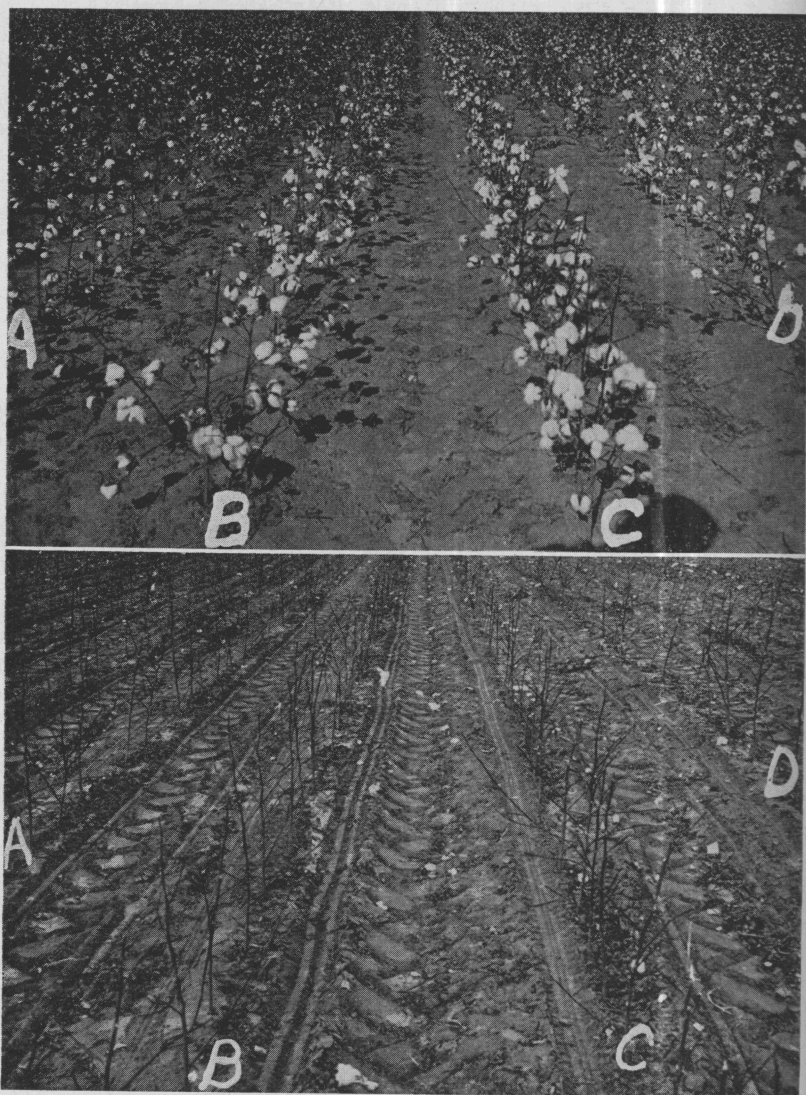


Figure 7. Top—showing yield and size of cotton plants before harvest at Lubbock in 1941. Bottom—showing field losses and condition of same plants after harvest. Varieties—left to right. A. Macha, B. Deltapine, C. Mebane 140, D. Mebane 140 x Mebane 804.

Again referring to Table 3 and the period of years average (Table 8), it is seen that the machine performed best when harvesting Holtz and Regular Ducona, or an average 92.6 and 92.2 percent respectively.

These varieties, however, were not included in the 1945 tests when the best performance of the machine for a single variety was 65.7 percent in harvesting Gorhams Lone Star. If the data for 1945 is disregarded it is found that Roldo Rowden ranked highest with a percentage of 94.6 of the cotton harvested for the period 1942-1944. Other high ranking varieties were Arkansas B-6, 93.2 percent; Western Early, 90.9 percent; Mebane 140, 91.9 percent; Macha, Suntex and Gorhams Lone Star, 91.7 percent. The average percentage of the cotton harvested by the machine for all varieties tested for the period 1939-1944 was 91.3. Hi-Bred because of its poor storm resistance, ranked lowest for the five year period 1939-1943, with a machine performance of 88.8 percent.

Next to the lowest average for the period 1939-1945 was for Oklahoma Triumph, and was 83.4 percent, though it did rank highest in 1944 with 96.2 percent. There was a difference between the highest and lowest of 9.3 percent, which may be largely attributed to varietal characteristics. The widest difference in a single year between the percentage of cotton harvested

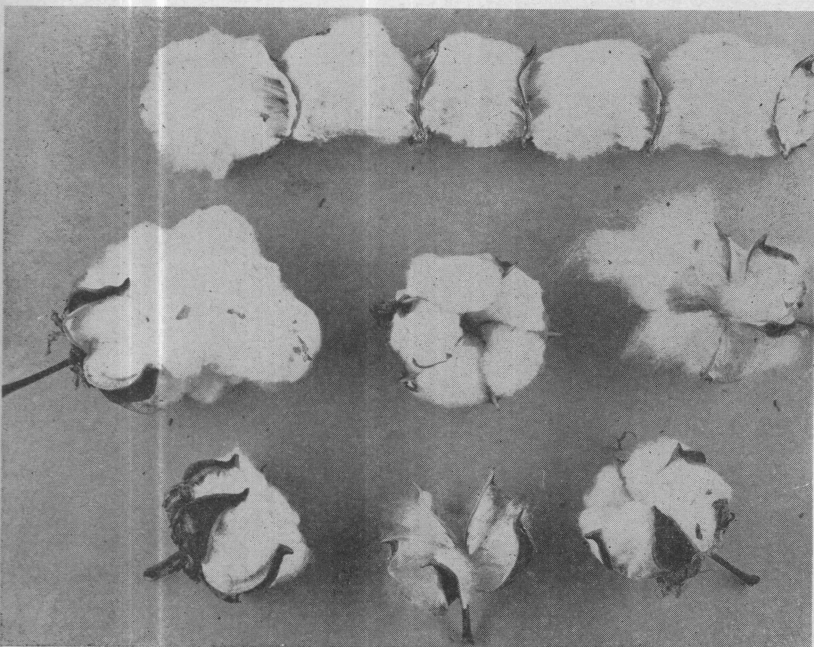


Figure 8. Bolls of stormproof Macha cotton showing non-fluffiness of locks and how fibers adhere to bur which makes it hard to remove locks from the bur.

from different varieties was 12.6 percent in 1943 and was between Roldo Rowden for a high of 95.6 and a low of 83.0 for Oklahoma Triumph.

*Performance at Lubbock:* Table 3 shows data on machine performance at Lubbock covering a six year period, 1939-1944. The general average in harvesting 14 varieties was 96.4 percent. The highest percentage was in 1941 when the average for 13 varieties was 98.5 percent (Figure 7). The lowest yearly average was for 1942 when 90.5 percent of the cotton was harvested. This decided drop in performance in 1942 was due to there being large branchy plants not suitable for machine stripping.

The difference in the average machine performance in harvesting different varieties was 6.8 percent. The highest efficiency in harvesting was 98.0 percent for Macha, and the lowest was 91.2 percent for Shafter x Half and Half x Shafter. The former was semi-dwarf in plant growth and had extra stormproof bolls, (Figures 8 and 9), while the latter developed a large branchy plant and quite fluffy cotton in the bolls (Figure 10). The highest percentage harvested from any variety was 99.8 percent from

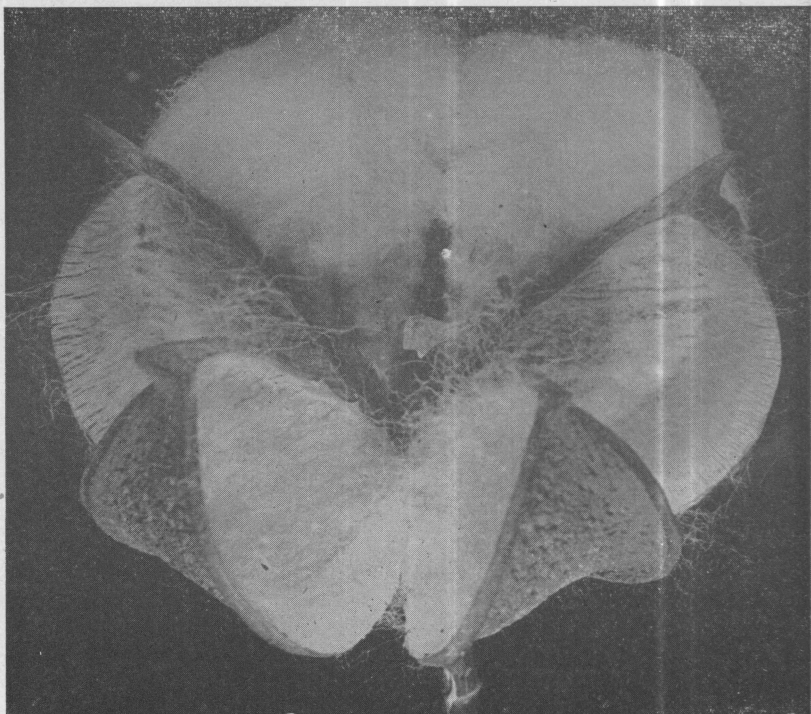


Figure 9. Single boll of stormproof Macha cotton showing two locks undisturbed, three locks removed and the fibers hanging to sides of the carpel and bur.

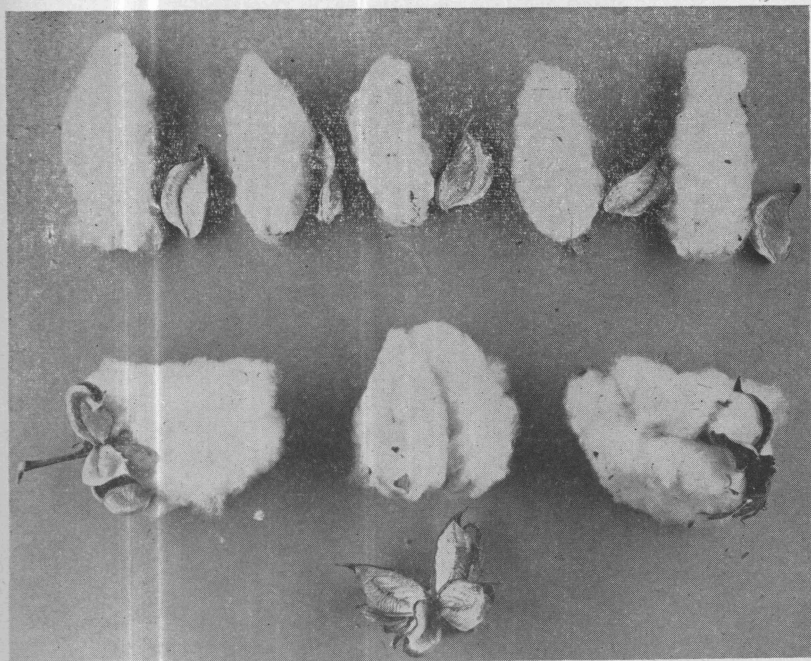


Figure 10. Normal bolls of Deltapine cotton showing fluffiness of locks and how the locks are easily removed from the bur leaving it clean.

Macha in 1944. The lowest was 83.8 percent from Shafter x Half and Half x Shafter in 1942, a difference of 16.0 percent.

*Comparison of Locations:* A study of Tables 3 and 8 shows that there was a difference of 7.4 percent in the average performance of the machine at College Station and Lubbock when all varieties are considered. Of all the varieties listed in the tests, seven were used at both locations from three to seven years. The average machine performance for these seven varieties when harvested at Lubbock was 96.7 percent. But, when harvested at College Station, the average was 89.2 percent, or a difference of 7.5 percent due to the difference in plant development at the two locations. At Lubbock the average plant height was 22.2 inches while at College Station the average was 28.6 inches, a difference of 6.4 inches, (Table 7).

Table 3. Cotton Harvested by the Texas Station Cotton Harvester (Stripper) at College Station and Lubbock, 1939-1945, in Percentage

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	94.0	84.4	94.3	95.5	93.0			92.2
Mebane 140	92.6	83.8	93.6	96.3	91.2	94.1		91.9
Rogers Acala	95.2	88.4	91.0	94.8	85.7			91.0
Western Early	95.0	84.7	87.2	94.5	89.0	94.9	61.3	86.7
Deltapine	94.3	85.2	84.9	93.1	88.7			89.2
Gorhams Lone Star	96.8	88.3	92.2	92.0	90.4	90.7	65.7	88.0
Hi-Bred	93.1	87.9	86.6	88.2	88.3			88.8
Mebane 804-50	94.7	87.9	86.4	89.1				89.5
Macha	96.2	85.3	91.9	93.5			62.4	85.9
Ducona 39-10	94.5	88.2	90.2	92.4				91.3
Oklahoma Triumph			85.9	93.8	83.0	96.2	57.9	83.4
Holtz			94.5	91.9	88.4	95.6		92.6
Mebane 804 x Mebane 140			90.7	94.3	88.4			91.1
Stoneville 2B				94.5	87.0			90.8
Roldo Rowden				92.9	95.6	95.3	62.2	86.5
Suntex				91.0	92.3			91.7
Arkansas B-6					93.4	93.0	63.5	83.3
Average	94.6	86.4	90.0	93.0	89.6	94.3	62.2	89.0
Lubbock								
Rogers Acala	98.5	96.4	97.5			98.3		97.7
Hi-Bred	98.8	96.6	97.8	86.5	97.4	98.8		96.0
Western Early	98.1	97.5	98.3	91.3		97.8		96.6
Ducona x Mebane 140	99.6	97.3	99.1	93.0				97.2
Ducona x Lone Star	98.1	95.8	99.6					97.8
Mebane 804 x Mebane 140	98.3	95.3	98.6					97.4
Macha	98.8	97.9	99.4	94.0		99.8		98.0
Ferguson 406	98.6	96.7	98.9	91.4				96.4
Burnett	99.1	94.8						97.0
Ducona x Half & Half	95.6	97.2	99.2					97.3
Half & Half x Acala	96.8	97.4	98.4	92.8				96.4
Deltapine		97.3	97.4	90.4	96.5	97.3		95.8
Mebane 140		96.9	98.3	91.2				95.5
Shafter x Half & Half x Shafter			98.6	83.8				91.2
Average	98.2	96.7	98.5	90.5	97.0	98.4		96.4

*Cotton Lost by Harvester:* The data in Table 4 show the pounds of lint cotton lost per acre by the Texas Station Cotton Harvester in harvesting the various varieties tested at both College Station and Lubbock. The losses, of course, are in inverse relation to the percentage of cotton harvested by the machine shown in Table 3. It is of interest, however, to see exactly the loss in pounds of lint per acre. At College Station the average loss for all varieties for the seven-year period, 1939-1945, was 24 pounds per acre. At 25 cents per pound this would be a loss of \$6.00 per acre. If, however, the poor results of 1945 are disregarded the average loss would be 19.2 pounds per acre, or \$4.80.

At Lubbock, the average lint lost per acre was 15.7 pounds, or \$3.92 per acre at 25 cents per pound. If the results for 1942 are disregarded the average loss would amount to only 8.4 pounds, or \$2.10 per acre.

*Cotton on Ground Before Harvesting:* In all the harvesting tests the cotton on the ground was picked up and the amount per acre calculated. The cotton was gleaned from the ground before harvest so that any cotton found on the ground after the machine was used would be charged as



Table 4. Pounds of Lint Cotton Lost Per Acre by the Texas Station Cotton Harvester at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	12.1	31.6	10.0	7.0	7.5			13.6
Mebane 140	21.8	38.7	19.8	17.0	7.7	16.0		20.2
Rogers Acala	15.4	26.3	23.6	10.0	15.8			18.2
Western Early	13.7	37.6	35.6	12.0	12.5	10.0	138.0	37.1
Deltapine	20.4	39.4	34.8	12.0	15.6			24.4
Gorhams Lone Star	5.7	20.5	15.8	17.0	10.8	26.0	68.0	23.4
Hi-Bred	21.9	35.8	36.2	19.0	13.2			25.2
Mebane 804-50	13.7	30.3	32.1	13.0				22.3
Macha	9.0	39.5	23.5	14.0			74.0	32.0
Ducona 39-10	14.6	23.2	13.3	17.0				17.0
Oklahoma Triumph			38.6	11.0	27.0	8.0	131.0	43.1
Holtz			12.0	17.0	11.6	7.0		11.9
Mebane 804 x Mebane 140			25.3	12.0	16.5			17.9
Stoneville 2B				10.0	16.4			13.2
Roldo Rowden				19.0	6.5	10.0	86.0	30.4
Suntex				21.0	7.9			14.4
Arkansas B-6					8.8	15.0	105.0	42.9
Average	14.8	32.3	24.7	14.2	12.7	13.1	100.3	24.0
Lubbock								
Rogers Acala	3.4	7.8	14.8			8.0		8.5
Hi-Bred	4.5	10.0	9.8	74.0	16.8	5.0		20.0
Western Early	1.9	7.4	6.3	71.0		8.0		18.9
Ducona x Mebane 140	1.4	6.7	14.6	34.0				14.2
Ducona x Lone Star	3.0	8.5	4.6					5.4
Mebane 804 x Mebane 140	4.4	10.8	6.1					7.1
Macha	3.3	7.1	2.9	48.0		11.0		14.5
Ferguson 406	5.3	7.2	5.4	48.0				16.5
Burnett	2.1	11.8						7.0
Ducona x Half & Half	3.1	5.4	4.2					4.2
Half x Half x Acala	11.9	6.6	7.5	46.0				18.0
Deltapine		7.8	16.0	75.0	6.9	18.0		24.7
Mebane 140		7.1	7.2	56.0				23.4
Shafter x Half & Half x Shafter			7.6	67.0				37.3
Average	4.0	8.0	8.2	57.7	11.8	10.0		15.7

machine loss. The data in Table 5 show the amount of seed cotton gleaned from each variety prior to harvest. These data give some indication as to the comparative storm resistance of the various varieties used in the tests which in turn may have some influence on the adaptability of the variety for machine harvesting.

It was stated above that Oklahoma Triumph gave poor machine performance. In Table 5, the data for College Station show that this variety was the highest for pre-harvest losses, or 31.0 pounds of seed cotton per acre. Other varieties that ranked high in pre-harvest losses were Mebane 804-50, Stoneville 2B, Mebane 804 x Mebane 140 and Hi-Bred. The lowest losses were for Macha, Arkansas B-6, Regular Ducona and Roldo Rowden. These varieties also ranked high in machine performance. There was slightly more than 1 percent difference in the average pre-harvest loss of cotton at College Station and Lubbock.

Table 5 shows that at Lubbock the highest pre-harvest losses were from Rogers Acala, Hi-Bred and Burnett, or 34.4, 24.8 and 23.4 pounds of seed cotton per acre respectively. The lowest pre-harvest losses were from

Table 5. Pounds of Seed Cotton on Ground Per Acre Before Harvesting with the Texas Station Cotton Harvester, at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	5.6	9	12.5		8.2			6.8
Mebane 140	11.2	1.6	33.1		6.3			13.0
Rogers Acala	15.0	4.2	35.0		15.4			17.4
Western Early	4.8	4	16.6		12.7		6.1	8.1
Deltapine	15.8	5	34.9		4.9			14.0
Gorhams Lone Star	5.6	3.3	15.9		19.7		9.6	10.8
Hi-Bred	15.5	1.6	62.8		6.4			21.6
Mebane 804-50	14.3	3.9	62.9					27.0
Macha	2.7	2.1	1.6				5.9	3.1
Ducona 39-10	6.4	8	13.9					7.0
Oklahoma Triumph			67.2		14.9		10.8	31.0
Holtz			14.0		11.5			12.8
Mebane 804 x Mebane 140			47.2		11.7			29.4
Stoneville 2B					25.1			25.1
Roldo Rowden					3.8		10.8	7.3
Suntex					12.9			12.9
Arkansas B-6					7.2		4.7	6.0
Average	9.7	1.9	32.1		11.5		8.0	14.9
Lubbock								
Rogers Acala	31.6	42.8	3.1			60.2		34.4
Hi-Bred	30.6	32.3	5.5	30.0		25.8		24.8
Western Early	1.6	13.3	2.9	4.6		4.8		5.4
Ducona x Mebane 140	2.2	25.3	.4	17.5				11.4
Ducona x Lone Star	1.2	18.6	.7					6.8
Mebane 804 x Mebane 140	14.6	4.5	5.2					8.1
Macha	.8	3.5	.0	4.4		2.0		2.1
Ferguson 406	12.0	4.9	1.0	15.1				8.2
Burnett	7.2	39.5						23.4
Ducona x Half & Half	10.5	12.5	1.6					8.2
Half & Half x Acala	21.4	22.5	1.8	23.5				17.3
Deltapine		36.9	4.0	21.0		12.6		18.6
Mebane 140		24.4	5.1	17.4				15.6
Shafter x Half & Half x Shafter			2.0	8.3				5.2
Average	12.2	21.6	2.6	15.8		21.1		13.5

Macha, Shafter x Half and Half x Shafter, Western Early and Ducona x Lone Star, or 2.1, 5.2, 5.4, and 6.8 pounds of seed cotton per acre respectively.

*Acre Yield of Lint:* Table 6 shows that the average acre yield of lint cotton for all varieties at Lubbock was 406 pounds in comparison with 224 pounds at College Station. For three of the five years at Lubbock, the average yield for all varieties was almost a bale to the acre. The yield at College Station dropped to 136 pounds in 1943 when the season was dry. The best year was in 1941 when 286 pounds were produced. This was also a year of good rainfall at optimum times during the growing season.

Of all the varieties tested at College Station, Deltapine yielded the highest with an average of 271 pounds of lint per acre. Stoneville 2B was lowest with 170 pounds.

A careful study of Tables 3, 6 and 8 does not show that the yield per acre consistently influenced the efficiency of the machine in the same way. That is, low yields did not consistently show high machine efficiency. The

Table 6. Pounds of Lint Cotton Produced Per Acre for the Various Varieties Harvested with the Texas Station Cotton Harvester at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	206	216	183	146	115			173
Mebane 140	305	239	337	245	133	273		255
Rogers Acala	331	246	294	192	126			238
Western Early	277	247	295	201	125	193	364	243
Deltapine	374	327	346	167	143			271
Gorhams Lone Star	182	190	219	208	133	286	207	204
Hi-Bred	333	298	334	228	119			262
Mebane 804-50	270	254	298	180				250
Macha	237	289	287	214			202	246
Ducona 39-10	271	199	231	225				232
Oklahoma Triumph			342	183	174	211	321	246
Holtz			232	216	116	172		184
Mebane 804 x Mebane 140			320	209	153			227
Stoneville 2B				187	152			170
Roldo Rowden				250	153	215	238	214
Suntex				235	117			176
Arkansas B-6					140	212	293	215
Average	279	250	286	205	136	223	271	224
Lubbock								
Rogers Acala	264	260	601			490		404
Hi-Bred	424	327	434	581	298	441		418
Western Early	128	310	373	812		346		394
Ducona x Mebane 140	391	271	534	495				423
Ducona x Lone Star	162	214	411					262
Mebane 804 x Mebane 140	277	257	426					320
Macha	266	337	518	816		505		488
Ferguson 406	399	254	505	570				432
Burnett	249	267						258
Ducona x Half & Half	242	207	550					333
Half & Half x Acala	398	279	484	662				456
Deltapine		324	609	799	423	661		563
Mebane 140		258	440	650				449
Shafter x Half & Half x Shafter			562	421				492
Average	291	274	496	645	360	489		406

same is true for high yields. For some years the machine efficiency was fairly uniform, even though there may have been quite a difference in the yield for the different varieties. In some cases, the machine efficiency was high for low yields, and in other cases it was high for high yields. Therefore, this would indicate that there are other plant characteristics that affect machine efficiency and performance more than just the yield. It is true, however, that a high yield per acre permits a greater field loss; yet the percentage of loss will not be as great as where there is a low yield with a high percentage of the cotton lost. This can be seen for College Station data when Regular Ducona and Holtz are compared with Mebane 140, Rogers Acala and Mebane 804 x Mebane 140.

At Lubbock, Burnett and Ducona x Lone Star yielded 258 and 262 pounds of lint per acre, but the machine efficiency was 97.0 and 97.8 percent respectively. When these varieties are compared with Mebane 140, with an average yield of 449 pounds, and Macha, with a yield of 488 pounds of lint per acre, with an average machine efficiency of 95.5 and 98.0 respectively, the small difference in machine efficiency cannot be attributed to the difference in acre yield of lint. The Macha and Mebane

Table 7. Average Plant Height in Inches for the Various Varieties Harvested with the Texas Station Cotton Harvester at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	32.0	42.5	31.1	30.9	26.5			32.6
Mebane 140	23.8	27.1	27.0	26.1	28.1	25.8	45.5	29.1
Rogers Acala	24.8	37.3	29.2	28.0	26.3			29.1
Western Early	24.2	29.0	25.2	26.1	26.3	26.0	36.2	27.6
Deltapine	31.1	37.6	25.5	24.5	26.1			29.0
Gorhams Lone Star	23.7	29.5	21.2	26.3	19.8	21.2	36.1	25.4
Hi-Bred	26.4	34.9	29.2	27.4	29.0			29.4
Mebane 804-50	27.2	24.8	28.9	30.1				27.8
Macha	25.6	33.5	25.2	24.3			45.0	30.7
Ducona 39-10		31.6	26.1	27.0				28.2
Oklahoma Triumph			29.2	24.0	28.0	24.1	40.3	29.1
Holtz			24.8	26.3	25.4	24.8		25.3
Mebane 804 x Mebane 140			28.9	31.4	23.6			28.0
Stoneville 2B				27.0	25.4			26.2
Roldo Rowden				26.1	26.3	24.7	43.3	30.1
Suntex				29.0	26.1			27.6
Arkansas B-6					25.8	25.5	43.7	31.7
Average	26.5	32.8	27.0	27.2	25.9	24.6	41.4	28.6
Lubbock								
Rogers Acala	13.9	15.9	28.6			22.7		20.3
Hi-Bred	16.8	11.6	20.8	34.7	17.2	20.0		20.2
Western Early	16.0	13.2	25.5	37.1		15.4		21.4
Ducona x Mebane 140	22.3	15.4	25.6	40.9				26.0
Ducona x Lone Star	20.8	13.3	20.0					18.0
Mebane 804 x Mebane 140	19.6	13.5	23.5					18.9
Macha	15.5	13.4	23.5	37.4		17.6		21.5
Ferguson 406	15.6	12.1	25.0	38.9				22.9
Burnett	15.2	14.1						14.6
Ducona x Half & Half	20.2	13.4	24.2					19.3
Half & Half x Acala	19.8	14.4	24.1	33.6				23.0
Deltapine		16.0	26.7	37.6	20.3	19.6		24.0
Mebane 140		13.7	24.0	37.9				25.2
Shafter x Half & Half x Shafter			25.2	46.3				35.8
Average	17.8	13.8	24.4	38.3	18.8	19.1		22.2

140 have plant characteristics such as stormproofness and short limbs that enable the machine to perform better when harvesting them than when harvesting other varieties.

*Plant Height:* The data in Table 7 show the average plant height for all varieties harvested each year with the Texas Station Cotton Harvester at College Station and Lubbock. The average height for the period 1939-1945 at College Station was 28.6 inches while at Lubbock for irrigated cotton the average height was 22.2 inches. Therefore, at College Station the cotton plants grew on the average 6.4 inches taller than they did at Lubbock.

In general, Table 7 shows that during those years when the plants grew tall the average machine efficiency was lowest. For example, in 1940 and 1945, the average plant height at College Station for all varieties was 32.8 and 41.4 inches respectively. Referring to Table 3, it is seen that during these years the machine efficiency averaged 86.4 and 62.2 percent. On the other hand, in 1939, 1942 and 1944, when the average plant height was 26.5, 27.2 and 24.6 inches respectively, the average machine efficiency was 94.6, 93.0 and 94.3 percent respectively.

Table 8. Average Percentage of Cotton Harvested by Machine, Pounds Lost Per Acre, Pounds Lint on Ground Before Harvest, Acre Yield and Plant Height for Varieties Harvested at College Station and Lubbock, 1939-1945

Variety	Cotton harvested by machine (Percent)	Lint lost per acre by stripper (pounds)	Lint per acre on ground before harvest (pounds)	Total acre yield of lint (pounds)	Average plant height (inches)
College Station					
Regular Ducona	92.2	13.6	6.8	173	32.6
Mebane 140	91.9	20.2	13.0	255	29.1
Rogers Acala	91.0	18.2	17.4	238	29.1
Western Early	86.7	37.1	8.1	243	27.6
Deltapine	89.2	24.4	14.0	271	29.0
Gorhams Lone Star	88.0	23.4	10.8	204	25.4
Hi-Bred	88.8	25.2	21.6	262	29.4
Mebane 804-50	89.5	22.3	27.0	250	27.8
Macha	85.9	32.0	3.1	246	30.7
Ducona 39-10	91.3	17.0	7.0	232	28.2
Oklahoma Triumph	83.4	43.1	31.0	246	29.1
Holtz	92.6	11.9	12.8	184	25.3
Mebane 804 x Mebane 140	91.1	17.9	29.4	227	28.0
Stoneville 2B	90.8	13.2	25.1	170	26.2
Roldo Rowden	86.5	30.4	7.3	214	30.1
Suntex	91.7	14.4	12.9	176	27.6
Arkansas B-6	83.3	42.9	6.0	215	31.7
Average	89.0	24.0	14.9	224	28.6
Lubbock					
Rogers Acala	97.7	8.5	34.4	404	20.3
Hi-Bred	96.0	20.0	24.8	418	20.2
Western Early	96.6	18.9	5.4	394	21.4
Ducona x Mebane 140	97.2	14.2	11.4	423	26.0
Ducona x Lone Star	97.8	5.4	6.8	262	18.0
Mebane 804 x Mebane 140	97.4	7.1	8.1	320	18.9
Macha	98.0	14.5	2.1	488	21.5
Ferguson 406	96.4	16.5	8.2	432	22.9
Burnett	97.0	7.0	23.4	258	14.6
Ducona x Half & Half	97.3	4.2	8.2	333	19.3
Half & Half x Acala	96.4	18.0	17.3	456	23.0
Deltapine	95.8	24.7	18.6	563	24.0
Mebane 140	95.5	23.4	15.6	449	25.2
Shafter x Half & Half x Shafter	91.2	37.3	5.2	492	35.8
Average	96.4	15.7	13.5	406	22.2

This indicates that the plant height, with its corresponding tendency to produce longer branches as the plant grows taller, has a definite influence on the efficiency and performance of the machine.

This same trend is seen for the data at Lubbock, which is also shown in Table 7. For example, in 1942 when the average plant height at Lubbock was 38.3 inches, the average machine efficiency was low with an average of 90.5 percent of the cotton on the plant harvested. For all other years when the average plant height did not range above 24.4 inches, the lowest average machine efficiency was 96.7 percent.

The length of the limbs on the plant is also a very important factor in influencing the efficiency of the machine. For example, it was observed that Regular Ducona, Mebane 140, Ducona 39-10, Holtz and Arkansas B-6 normally had relatively short branches. It can be seen from Table 3 that, for College Station, the average machine efficiency for these varieties

was 92.2, 91.9, 91.3, 92.6 and 93.2 percent respectively, if the results for 1945 are not included. On the other hand, varieties that produced numerous long branches, such as Deltapine, Gorhams Lone Star, Hi-Bred, Mebane 804-50 and Oklahoma Triumph, gave a machine efficiency of 89.2, 88.0, 88.8, 89.5 and 83.4 percent respectively for the period of years tested.

At Lubbock, in 1942, the wide spreading, branchy plants of Shafter x Half and Half x Shafter, which averaged 46.3 inches tall, gave a machine efficiency of 83.8 percent, while Mebane 140 and Ducona x Mebane 140 with shorter limbs and an average plant height of 37.9 and 40.9 inches, gave a machine efficiency of 91.2 and 93.0 percent respectively.

Hi-Bred plants grew to an average height of 34.7 inches at Lubbock in 1942 and gave a low machine efficiency of 86.5 percent, largely because of the ease with which the compact locks shattered at the least shock given the plant. Table 4 shows that the field loss for Hi-Bred was 74 pounds of lint per acre for that year. Other varieties of low storm resistance gave high field losses in harvesting.

### Performance of the Texas Station Cotton Extractor

The extractor unit developed in connection with this study was designed as a field tractor mounted and operated extractor, to be used in conjunction with the Texas Station Cotton Harvester (Figure 2). In operation, the cotton passes directly from the harvester unit into the extractor unit. A pan attached underneath the extractor catches all the burs and waste. Therefore, the amount of cotton left in the burs, and that which might drop through the fingers was collected, and the percentage of cotton lost by the extractor was determined separately from that lost by the harvester unit.

*Cotton Lost by the Extractor Unit:* The pounds of lint cotton lost per acre by the extractor for the various varieties harvested at both College Station and Lubbock are shown in Table 9. The average pounds of lint lost per acre for all varieties at College Station was 10 pounds for the seven-year period, 1939-1945. At Lubbock, the average loss was 26.1 pounds of lint per acre. This difference in loss is attributed largely to the difference in the acre yield at the two locations (Table 6). It is obvious that a larger volume of cotton passing through the machine would cause more pounds of cotton to be lost. The loss of 10 pounds per acre by the extractor amounted to 4.5 percent of the average total yield of 224 pounds per acre at College Station. At Lubbock, the loss of 26.1 pounds of lint per acre by the extractor amounted to 6.4 percent of the total acre yield.

A study of the averages for the different varieties in Table 9 reveals that the loss by the extractor varied considerably when varieties are compared. For example, at College Station the lowest loss of 6.7 pounds was for Deltapine, a fluffy cotton (Figure 10), and highest was 23.0 pounds for Macha, a very tight stormproof cotton (Figures 8 and 9). At Lubbock, Burnett gave a low loss for the two-year period, 1939-1940. Low yields

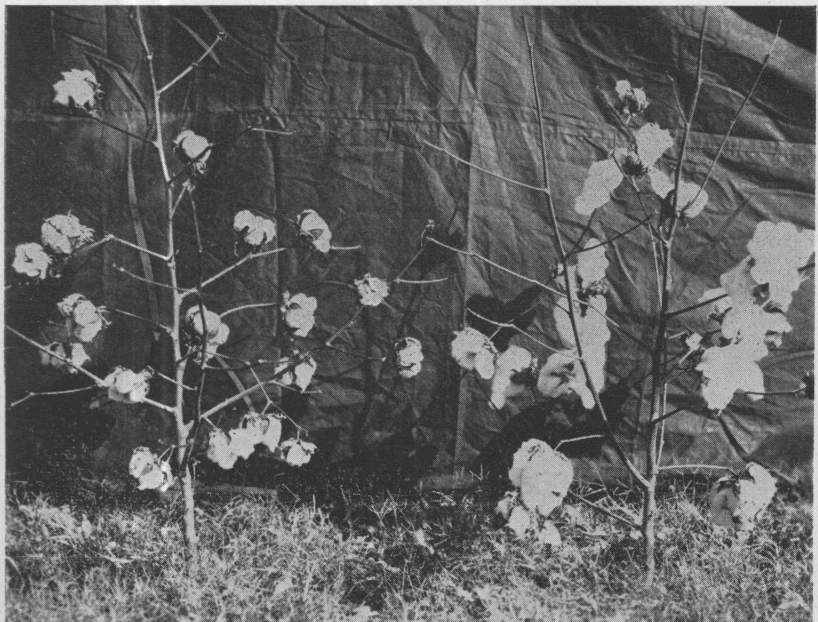


Figure 11. Close up view of single plants of stormproof cotton on left and normal fluffy type on right.



Figure 12. Field scene at Lubbock 1945 showing stormproof Macha cotton on left and normal fluffy Deltapine cotton on right.

were also obtained during these years. Shafter x Half and Half x Shafter and Mebane 140 gave high average losses during 1941 and 1942, years when all varieties showed a high loss.

A close analysis of the data in Table 9 and Table 25 will show that two factors stand out as causes of excessive losses by the extractor. The first is the stormproofness of the variety. At both locations, Macha gave a high extractor loss. This variety is extremely stormproof and, therefore, very hard to extract. Varieties that produce a fluffy lock and cotton that is easily caught by the extractor saw teeth gave fairly low losses. Figures 11 and 12 show a comparison of fluffiness, of stormproof and of normal types of cotton. Figure 13 shows a short limb type of plant with intermediate stormproof bolls.

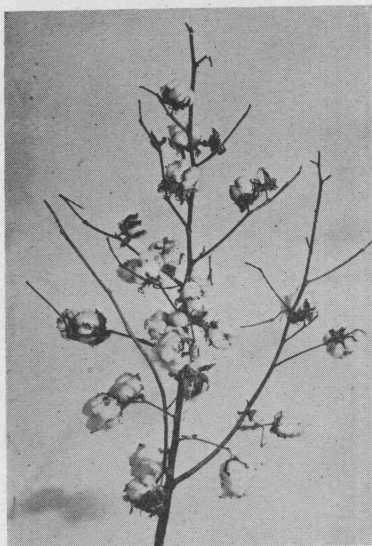


Figure 13. Strain of cotton with short limbs and intermediate stormproof bolls. This strain was found at Lubbock in 1945.

The second factor is the staple length combined with a compact lock. Hi-Bred which produced a staple averaging 26/32 inch at College Station and 26.7/32 inch at Lubbock shows a high extractor loss at both locations (Table 9).

Other factors such as size of boll, the degree which the boll carpels spread apart when open, the amount of limbs pulled off with the bolls, the percentage of green bolls on the plant and bursted by the extractor, and how close the points of the extractor fingers are adjusted to the extractor saw drum, will influence the amount of cotton lost by the extractor. If the points of the fingers are set close to the saw, the burs do not drop through the space as freely as when they are set farther away from the saw drum. This factor, together with the yield, probably had considerable influence on the variable losses from year to year. In operation, an attempt was made to adjust the fingers

to suit the conditions encountered each year.

*Burs and Waste Removed from Stripped Cotton by Extractor:* When harvesting the various varieties at College Station and Lubbock, a pan was suspended underneath the extractor to catch all the waste in the form of burs and trash. As can be seen in Table 10, different percentages of waste were removed from machine-stripped cotton for different varieties and at the two locations. At College Station, an average of 34.1 percent of the material harvested was removed by the extractor as burs and waste, while at Lubbock the percentage was 28.7. The data disclose that the



Table 9. Pounds of Lint Cotton Lost Per Acre by the Texas Station Extractor at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	6.1	4.9	11.9	14.0	5.3			8.4
Mebane	10.4	4.9	14.5	16.0	4.9	13.0		10.6
Rogers Acala	9.1	8.7	13.0	26.0	4.9			12.3
Western Early	7.6	5.1	11.0	11.0	4.6	11.0	7.2	8.2
Deltapine	8.5	4.1	7.8	8.0	5.2			6.7
Gorhams Lone Star	5.1	3.4	8.1	11.0	4.0	14.0	3.9	7.1
Hi-Bred	17.0	12.2	20.0	21.0	9.6			16.0
Mebane 804-50	6.1	4.9	13.0	10.0				8.5
Macha	12.2	7.1	34.0	37.0			24.9	23.0
Ducona 39-10	6.5	6.5	9.8	11.0				8.4
Oklahoma Triumph			13.3	12.0	5.1	14.0	7.5	10.4
Holtz			11.9	10.0	4.5	11.0		9.4
Mebane 804 x Mebane 140			15.0	10.0	5.2			10.1
Stoneville 2B				11.0	4.5			7.8
Roldo Rowden				17.0	4.2	11.0	5.0	9.3
Suntex				9.0	4.9			7.0
Arkansas B-6					4.9	12.0	5.7	7.5
Average	8.9	6.2	14.1	14.6	5.1	12.3	9.0	10.0
Lubbock								
Rogers Acala	7.5	6.2	54.8			15.0		20.9
Hi-Bred	18.7	11.7	66.3	41.0	4.1	5.0		24.5
Western Early	18.6	5.6	28.3	33.0		3.0		17.7
Ducona x Mebane 140	4.7	4.1	66.3	30.0				26.3
Ducona x Lone Star	3.9	4.5	63.7					24.0
Mebane 804 x Mebane 140	3.3	2.9	38.5					14.9
Macha	11.6	3.2	103.7	40.0		18.0		35.3
Ferguson 406	5.8	3.2	60.7	33.0				25.7
Burnett	4.8	4.3						4.6
Ducona x Half and Half	3.9	4.9	76.1					28.3
Half and Half x Acala	6.5	4.0	52.5	30.0				23.2
Deltapine		4.9	55.6	12.0	6.8	13.0		18.5
Mebane 140		5.0	64.5	53.0				40.8
Shafter x Half & Half x Shafter			92.0	30.0				61.0
Average	8.1	5.0	63.3	33.6	5.4	10.8		26.1

lowest percentage of waste for both College Station and Lubbock was for the stormproof variety, Macha. As the cotton did not fluff or protrude out of the boll, and fibers adhered to the carpel walls (Figures 8 and 9), the extractor saw teeth chipped and cut the burs so badly that an excessive amount of bur particles passed out with the seed cotton. This, of course, reduced the total weight of the bur waste and at the same time added to the weight of the seed cotton, thereby affecting the percentage of waste.

Varieties that normally produce a heavy bur, a great number of bolls, or bolls with large peduncles, usually rank high in percentage of waste. Regular Ducona and Ducona 39-10 produced large burs and thick heavy stems, and the percentage of burs and waste removed by the extractor was 37.9 and 37.4 percent respectively at College Station. The brittleness of the limbs will also affect the amount of waste, as at Lubbock, Shafter x Half and Half x Shafter produced numerous fairly long branches, a number of which were pulled off in harvesting. Consequently, the percentage of burs and waste was high for the location, or 33.8 percent.

It is noted from the data in Table 10 that the average percentage of

burs and waste was higher at College Station for the same varieties and for all varieties collectively. This can be attributed largely to the condition of the plant at the time of harvest. For example, at College Station the average date of harvest was September 14. At this time the plants were in full foliage. Consequently, considerable green leaves were removed from the plant in harvesting. The plants were larger, more sappy and more limbs and twigs broke off in harvesting. This, of course, resulted in more waste.

At Lubbock, the average date of harvest was November 14, or soon after the first killing frost. At this time the plants were free of green vegetation and had not become dry and brittle, consequently, less trash was collected with the stripped cotton. It is of interest to note that when cotton was stripped with the Texas Station Harvester soon after the first freeze, the percentage of waste removed each year was fairly constant. It was observed, however, that when cotton was stripped several weeks after the first freeze, the amount of the waste, consisting largely of plant sections, increased considerably. An additional amount of waste was removed in the cleaning process. These percentages are given in Table 17

Table 10. Burs and Trash Removed From Samples of Machine-stripped Cotton by the Texas Station Extractor at College Station and Lubbock, 1939-1945, in Percentage

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	37.8	51.0	37.5	28.9	34.5			37.9
Mebane 140	32.1	41.4	30.1	28.6	27.3	25.0		30.8
Rogers Acala	38.9	43.8	34.4	30.5	38.0			37.1
Western Early	36.5	42.3	28.7	35.1	32.4	31.2	28.8	33.6
Deltapine	35.7	42.9	32.4	34.9	33.9			36.0
Gorham's Lone Star	39.4	42.8	34.2	33.0	35.2	28.4	34.9	35.4
Hi-Bred	30.5	39.2	34.8	33.2	32.3			34.0
Mebane 804-50	37.9	42.3	34.3	34.0				37.1
Macha	35.0	38.2	24.5	22.9			32.9	30.7
Ducona 39-10	35.9	47.2	35.5	31.2				37.4
Oklahoma Triumph			34.4	36.1	32.1	27.9	31.2	32.3
Holtz			30.8	29.4	33.6	31.4		31.3
Mebane 804 x Mebane 140			32.8	29.5	35.4			32.6
Stoneville 2B				33.4	35.2			34.3
Roldo Rowden				33.8	34.0	29.8	36.7	33.6
Suntex				33.8	34.9			34.4
Arkansas B-6					33.3	29.0	33.2	31.8
Average	36.0	43.1	32.6	31.8	33.7	29.0	33.0	34.1
Lubbock								
Rogers Acala	31.5	27.2				28.6		29.1
Hi-Bred	30.0	25.0		27.4	32.7	23.2		27.7
Western Early	37.3	26.5		20.3		26.9		27.8
Ducona x Mebane 140	29.5	28.8		32.5				30.3
Ducona x Lone Star	34.5	26.4						30.5
Mebane 804 x Mebane 140	33.6	30.8						32.2
Macha	30.9	19.9		21.3		18.1		22.6
Ferguson 406	32.9	27.9		28.5				29.8
Burnett	30.8	32.5						31.6
Ducona x Half and Half	26.7	25.3						26.0
Half and Half x Acala		29.0		25.3				27.2
Deltapine		29.7		24.2	32.1	22.8		27.2
Mebane 140		27.0		25.5				26.2
Shafter x Half & Half x Shafter				33.8				33.8
Average	31.8	27.4		26.5	32.4	23.9		28.7

and are discussed under "Waste Removed in Cleaning Machine-stripped and Hand-snapped Seed Cotton."

*Burs and Waste Removed from Hand-snapped Cotton by Extractor:* Samples of hand-snapped cotton were harvested as nearly as possible at the same time as the machine-stripped cotton. Usually there was one day's difference in the date of harvest. The hand-snapped samples were harvested the day before the machine was to be used. This was done so that the ginned samples could be readily compared as to grade, thus showing the effect of method of harvesting.

The data in Table 11 show that the average waste in the form of burs and trash removed from hand-snapped cotton was 1 percent more than that removed from machine-stripped cotton for all the varieties harvested at College Station. At Lubbock, there was only a fraction of 1 percent difference in the amount of waste removed from machine-stripped and hand-snapped cotton.

In most cases, the percentages of waste removed for each method of harvesting are close.

Table 11. Burs and Trash Removed by the Texas Station Extractor from Samples of Hand-snapped Cotton at College Station and Lubbock, 1939-1945, in Percentage

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	31.8	35.1	38.3	33.3	37.3	.....	.....	35.2
Mebane 140	29.1	27.2	36.5	28.8	35.8	29.1	.....	31.1
Rogers Acala	33.9	38.6	39.8	40.5	36.7	36.7	.....	37.7
Western Early	31.2	30.9	39.7	34.9	38.7	32.1	29.2	33.8
Deltapine	32.5	35.4	40.9	30.6	37.1	41.1	.....	36.3
Gorhams Lone Star	33.4	38.2	42.0	38.1	36.4	31.9	31.0	35.9
Hi-Bred	31.0	28.6	39.6	32.4	32.8	39.4	.....	34.0
Mebane 804-50	30.6	28.7	39.2	37.0	.....	.....	.....	33.9
Macha	32.3	30.8	29.9	31.2	.....	43.7	.....	33.6
Ducona 39-10	31.6	31.0	42.1	37.8	.....	.....	.....	35.6
Oklahoma Triumph	.....	.....	41.6	30.6	53.9	30.9	29.1	37.2
Holtz	.....	.....	35.2	33.5	34.0	31.3	.....	33.5
Mebane 804 x Mebane 140	.....	.....	40.2	35.2	36.4	.....	.....	37.3
Stoneville 2B	.....	.....	.....	33.2	37.7	.....	.....	35.5
Roldo Rowden	.....	.....	.....	41.4	35.6	31.9	31.9	35.2
Suntex	.....	.....	.....	38.1	35.4	.....	.....	36.8
Arkansas B-6	.....	.....	.....	.....	36.5	33.7	33.1	34.4
Average	31.7	32.4	38.8	34.8	37.4	34.7	30.9	35.1
Lubbock								
Rogers Acala	32.7	26.5	29.7	.....	.....	.....	.....	29.6
Hi-Bred	32.7	27.9	26.6	30.0	37.7	.....	.....	31.0
Western Early	35.4	25.3	29.9	21.9	.....	.....	.....	28.1
Ducona x Mebane 140	32.4	29.9	27.5	31.8	.....	.....	.....	30.4
Ducona x Lone Star	33.3	26.4	28.3	.....	.....	.....	.....	29.3
Mebane 804 x Mebane 140	30.6	29.3	26.8	.....	.....	.....	.....	28.9
Macha	25.6	18.0	18.9	21.3	.....	.....	.....	21.0
Ferguson 406	30.8	24.4	24.3	31.9	.....	.....	.....	27.8
Burnett	31.8	31.0	.....	.....	.....	.....	.....	31.4
Ducona x Half and Half	.....	26.2	26.6	.....	.....	.....	.....	26.4
Half and Half x Acala	.....	29.4	27.0	33.8	.....	.....	.....	30.0
Deltapine	.....	26.5	27.5	29.8	34.6	.....	.....	29.6
Mebane 140	.....	24.1	25.7	32.4	.....	.....	.....	27.4
Shafter x Half & Half x Shafter	.....	.....	26.0	34.2	.....	.....	.....	30.1
Average	31.7	26.5	26.5	29.7	36.2	.....	.....	28.6

*Seed Cotton in Machine-stripped and Hand-snapped Cotton:* It is obvious that if the stripped cotton is considered as 100 percent of the material harvested, and that a certain percentage is removed as waste the remaining material will be the percentage of seed cotton in the original amount harvested. Consequently, the percentages of extracted cotton shown in Tables 12 and 13 will vary directly as the percentages of waste shown in Tables 10 and 11 vary.

The general average for both the percentages of waste and extracted seed cotton are shown for better comparison in Tables 14 and 15.

### Waste Removed in Cleaning Extracted Seed Cotton

After the machine-stripped cotton had been run through the extractor and the burs and as much trash removed as possible by the extractor, the cotton was then cleaned. The Texas Station Vertical Cleaner was used to clean the cotton harvested from all the different varieties for the seven-year period, 1939-1945.

Table 12. Seed Cotton in Machine-stripped Material at College Station and Lubbock, 1939-1945, in Percentage

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona.....	62.2	49.0	62.5	71.1	65.5	.....	.....	62.1
Mebane 140.....	67.9	58.6	69.9	71.4	72.7	75.0	.....	69.2
Rogers Acala.....	61.1	56.2	65.6	69.5	62.0	.....	.....	62.9
Western Early.....	63.5	57.7	71.3	64.9	67.6	68.8	71.2	66.4
Deltapine.....	64.3	57.1	67.6	65.1	66.0	.....	.....	64.0
Gorhams Lone Star.....	60.6	57.2	65.8	67.0	64.8	71.6	65.1	64.6
Hi-Bred.....	69.5	60.8	65.2	66.8	67.7	.....	.....	66.0
Mebane 804-50.....	62.1	57.7	65.7	66.0	.....	.....	.....	62.9
Macha.....	65.0	61.8	75.5	77.1	.....	.....	67.1	69.3
Ducona 39-10.....	64.1	52.8	64.5	68.8	.....	.....	.....	62.6
Oklahoma Triumph.....	.....	.....	65.5	63.9	67.9	72.1	68.8	67.6
Holtz.....	.....	.....	69.2	70.6	66.4	68.6	.....	68.7
Mebane 804 x Mebane 140.....	.....	.....	67.2	70.5	64.6	.....	.....	67.4
Stoneville 2B.....	.....	.....	.....	66.6	64.8	.....	.....	65.7
Roldo Rowden.....	.....	.....	.....	66.2	66.0	70.2	63.3	66.4
Suntex.....	.....	.....	.....	66.2	65.1	.....	.....	65.6
Arkansas B-6.....	.....	.....	.....	.....	66.7	71.0	66.8	68.2
Average.....	64.0	56.9	67.3	68.2	66.3	71.0	67.0	65.9
Lubbock								
Rogers Acala.....	68.5	72.8	.....	.....	.....	71.4	.....	70.9
Hi-Bred.....	70.0	75.0	.....	72.6	67.3	76.8	.....	72.3
Western Early.....	62.7	73.5	.....	79.7	.....	73.1	.....	72.2
Ducona x Mebane 140.....	70.5	71.2	.....	67.5	.....	.....	.....	69.7
Ducona x Lone Star.....	65.5	73.6	.....	.....	.....	.....	.....	69.6
Mebane 804 x Mebane 140.....	66.4	69.2	.....	.....	.....	.....	.....	67.8
Macha.....	69.1	80.1	.....	78.7	.....	81.9	.....	77.4
Ferguson 406.....	67.0	72.0	.....	71.5	.....	.....	.....	70.2
Burnett.....	69.2	67.5	.....	.....	.....	.....	.....	68.4
Ducona x Half and Half.....	.....	74.7	.....	.....	.....	.....	.....	74.7
Half and Half x Acala.....	.....	71.0	.....	74.7	.....	.....	.....	72.8
Deltapine.....	.....	70.3	.....	75.8	67.9	77.2	.....	72.8
Mebane 140.....	.....	73.0	.....	74.5	.....	.....	.....	73.8
Shafter x Half & Half x Shafter.....	.....	.....	.....	66.2	.....	.....	.....	66.2
Average.....	67.7	72.6	.....	73.5	67.6	76.1	.....	71.3

Table 13. Seed Cotton in Hand-snapped Material at College Station and Lubbock, 1939-1945, in Percentage

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	68.2	64.9	61.7	66.7	62.7	.....	.....	64.8
Mebane 140	70.9	72.8	63.5	71.2	64.2	70.9	.....	68.9
Rogers Acala	66.1	61.4	60.2	59.5	63.3	63.3	.....	62.3
Western Early	68.8	69.1	60.3	65.1	61.3	67.9	70.8	66.2
Deltapine	67.5	64.6	59.1	69.4	62.9	58.9	.....	63.7
Gorhams Lone Star	66.6	61.8	58.0	61.9	63.6	68.1	69.0	64.1
Hi-Bred	69.0	71.4	60.4	67.6	67.2	60.6	.....	66.0
Mebane 804-50	69.4	71.3	60.8	63.0	.....	.....	.....	66.1
Macha	67.7	69.2	70.1	68.8	.....	56.3	.....	66.4
Ducona 39-10	68.4	69.0	57.9	62.2	.....	.....	.....	64.4
Oklahoma Triumph	.....	.....	58.4	69.4	46.1	69.1	70.9	62.8
Holtz	.....	.....	64.8	66.5	66.0	68.7	.....	66.5
Mebane 804 x Mebane 140	.....	.....	59.8	64.8	63.6	.....	.....	62.7
Stoneville 2B	.....	.....	.....	66.8	62.3	.....	.....	64.6
Roldo Rowden	.....	.....	.....	58.6	64.4	68.1	68.1	64.8
Suntex	.....	.....	.....	61.9	64.6	.....	.....	63.2
Arkansas B-6	.....	.....	.....	.....	63.5	66.3	66.9	65.6
Average	68.3	67.6	61.2	65.2	62.6	65.3	69.1	64.9
Lubbock								
Rogers Acala	67.3	73.5	70.3	.....	.....	.....	.....	70.4
Hi-Bred	67.3	72.1	73.4	70.0	62.3	.....	.....	69.0
Western Early	64.6	74.7	70.1	78.1	.....	.....	.....	71.9
Ducona x Mebane 140	67.6	70.1	72.5	68.2	.....	.....	.....	69.6
Ducona x Lone Star	66.7	73.6	71.7	.....	.....	.....	.....	70.7
Mebane 804 x Mebane 140	69.4	70.7	73.2	.....	.....	.....	.....	71.1
Macha	74.4	82.0	81.1	78.7	.....	.....	.....	79.0
Ferguson 406	69.2	75.6	75.7	68.1	.....	.....	.....	72.2
Burnett	68.2	69.0	.....	.....	.....	.....	.....	68.6
Ducona x Half and Half	.....	73.8	73.4	.....	.....	.....	.....	73.6
Half and Half x Acala	.....	70.7	73.0	66.2	.....	.....	.....	70.0
Deltapine	.....	73.5	72.5	70.2	65.4	.....	.....	70.4
Mebane 140	.....	75.9	74.3	67.6	.....	.....	.....	72.6
Shafter x Half & Half x Shafter	.....	.....	74.0	65.8	.....	.....	.....	69.9
Average	68.3	73.4	73.5	70.3	63.9	.....	.....	71.4

*Waste Removed from Machine-stripped Cotton by Cleaner:* The data in Table 16 show the percentage of waste removed from each variety for each year the variety was tested. An average of 7.3 percent of the weight of the cotton, after extracting, was removed as waste at College Station and 5.8 percent at Lubbock. The higher percentage of waste removed from the cottons grown and harvested at College Station than from those grown and harvested at Lubbock, can be again largely attributed to condition of the cotton plants at the time of harvest. That is, the plants were larger, more tender and sappy, and they were, in most cases, in full foliage when harvested at College Station. Therefore, even though the extractor removed a slightly higher percentage of the trash in relation to the total amount of material harvested, there was more trash left in the cotton. The cleaner, thus, removed an additional percentage. The grade of the cottons shown in Table 21 also reflects the fact that there was an excessive amount of trash left in the lint cotton after ginning.

The data in Tables 16 and 17 do not reflect the cleaning quality of a particular variety in comparison with another variety, even though the

Table 14. Burs and Trash Removed by Extractor from Samples of Machine-stripped Cotton and Seed Cotton in Harvested Material at College Station and Lubbock, 1939-1945, in Percentage

Variety	Burs and trash in material harvested	Seed cotton in material harvested
College Station		
Regular Ducona	37.9	62.1
Mebane 140	30.8	69.2
Rogers Acala	37.1	62.9
Western Early	33.6	66.4
Deltapine	36.0	64.0
Gorhams Lone Star	35.4	64.6
Hi-Bred	34.0	66.0
Mebane 804-50	37.1	62.9
Macha	30.7	69.3
Ducona 39-10	37.4	62.6
Oklahoma Triumph	32.3	67.6
Holtz	31.3	68.7
Mebane 804 x Mebane 140	32.6	67.4
Stoneville 2B	34.3	65.7
Roldo Rowden	33.6	66.4
Suntex	34.4	65.6
Arkansas B-6	31.8	68.2
Average	34.1	65.9
Lubbock		
Rogers Acala	29.1	70.9
Hi-Bred	27.7	72.3
Western Early	27.8	72.2
Ducona x Mebane 140	30.3	69.7
Ducona x Lone Star	30.5	69.6
Mebane 804 x Mebane 140	32.2	67.8
Macha	22.6	77.4
Ferguson 406	29.8	70.2
Burnett	31.6	68.4
Ducona x Half and Half	26.0	74.7
Half and Half x Acala	27.2	72.8
Deltapine	27.2	72.8
Mebane 140	26.2	73.8
Shafter x Half & Half x Shafter	33.8	66.2
Average	28.7	71.3

two varieties may have contained an equal amount of waste before they were extracted. If the variety had good cleaning qualities, the extractor would remove more waste in the extracting process than it would from a variety that had poor cleaning qualities. For example, it is known that Hi-Bred is a good cleaning cotton in comparison with Deltapine, yet there is only 0.5 percent difference in the percentage of waste removed in the cleaning process for the same period of years. At College Station, the average grade for Hi-Bred for the period was SLM+, while for Deltapine it was LM+, or a difference of one grade, indicating that there was considerably more waste in the Deltapine than in the Hi-Bred lint when ginned and classed.

At Lubbock, for the same two varieties, less waste was removed from Hi-Bred than from Deltapine, but Hi-Bred classed M+, while Deltapine classed SLM, or a difference of 1½ grades. It should be noted in this comparison that the staple length for Hi-Bred averaged 26/32 inch in

Table 15. Average Burs and Trash Removed from Samples of Hand-snapped Cotton by Extractor and of Seed Cotton in Snapped Cotton, College Station and Lubbock, 1939-1945, in Percentage

Variety	Burs and trash in snapped cotton	Clean seed cotton in snapped cotton
College Station		
Regular Ducona.....	35.2	64.8
Mebane 140.....	31.1	68.9
Rogers Acala.....	37.7	62.3
Western Early.....	33.8	66.2
Deltapine.....	36.3	63.7
Gorhams Lone Star.....	35.9	64.1
Hi-Bred.....	34.0	66.0
Mebane 804-50.....	33.9	66.1
Macha.....	33.6	66.4
Ducona 39-10.....	35.6	64.4
Oklahoma Triumph.....	37.2	62.8
Holtz.....	33.5	66.5
Mebane 804 x Mebane 140.....	37.3	62.7
Stoneville 2B.....	35.5	64.6
Roldo Rowden.....	35.2	64.8
Suntex.....	36.8	63.2
Arkansas B-6.....	34.4	65.6
Average.....	35.1	64.9
Lubbock		
Rogers Acala.....	29.6	70.4
Hi-Bred.....	31.0	69.0
Western Early.....	28.1	71.9
Ducona x Mebane 140.....	30.4	69.6
Ducona x Lone Star.....	29.3	70.7
Mebane 804 x Mebane 140.....	28.9	71.1
Macha.....	21.0	79.0
Ferguson 406.....	27.8	72.2
Burnett.....	31.4	68.6
Ducona x Half and Half.....	26.4	73.6
Half and Half x Acala.....	30.0	70.0
Deltapine.....	29.6	70.4
Mebane 140.....	27.4	72.6
Shafter x Half and Half x Shafter.....	30.1	69.9
Average.....	28.6	71.4

length at College Station, and 26.7/32 inch at Lubbock. Deltapine averaged 29.5/32 and 30.2/32 inch in length for the two locations, respectively.

*Waste Removed from Hand-snapped Cotton by Cleaner:* As hand-snapped cotton contained both the bur and the cotton, it was run through the Station Extractor before cleaning and ginning to separate the burs and cotton. For comparison with machine-stripped cotton, the data in Table 17 show the percentages of waste removed from hand-snapped cotton in the cleaning process only. A study of the data in Table 17 reveals that the percentage of waste removed from the various varieties harvested at College Station and Lubbock averaged approximately the same, or 5.3 and 5.1 percent respectively. This was less than the difference for machine-stripped cotton for the two locations. It is to be expected that less waste and a more constant amount, will be found in hand-snapped cotton than in machine-stripped cotton, as only the bolls were snapped from the plants.

At College Station, there was 2 percent more waste removed from

Table 16. Additional Waste Removed by the Texas Station Cleaner from Samples of Extracted Stripped Cotton at College Station and Lubbock, 1939-1945, in Percentage

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	7.2	19.9	5.4	3.0	4.8	.....	.....	8.1
Mebane 140	6.5	16.3	8.0	3.6	6.3	4.6	.....	7.6
Rogers Acala	11.0	14.1	4.3	3.0	4.6	.....	.....	7.4
Western Early	10.5	14.0	5.7	8.5	5.6	6.6	2.5	7.6
Deltapine	9.8	14.6	5.0	5.2	5.4	.....	.....	8.0
Gorhams Lone Star	11.7	10.8	7.5	2.4	7.0	7.5	12.8	8.5
Hi-Bred	5.4	13.2	9.2	8.8	5.8	.....	.....	8.5
Mebane 804-50	11.8	14.4	5.8	4.3	.....	.....	.....	9.1
Macha	8.0	14.8	6.2	3.7	.....	.....	7.3	8.0
Ducona 39-10	9.8	18.6	6.6	7.6	.....	.....	.....	10.6
Oklahoma Triumph	.....	.....	5.9	4.7	5.7	4.8	7.7	5.8
Holtz	.....	.....	4.0	2.4	6.1	6.7	.....	4.8
Mebane 804 x Mebane 140	.....	.....	5.1	1.8	8.9	.....	.....	5.3
Stoneville 2B	.....	.....	.....	7.5	8.9	.....	.....	8.2
Roldo Rowden	.....	.....	.....	3.0	5.4	3.7	9.2	5.3
Suntex	.....	.....	.....	2.1	6.8	.....	.....	4.4
Arkansas B-6	.....	.....	.....	.....	6.0	4.7	10.2	7.0
Average	9.2	15.1	6.1	4.5	6.2	5.5	8.3	7.3
Lubbock								
Rogers Acala	4.9	3.8	4.4	.....	.....	3.6	2.9	3.9
Hi-Bred	5.8	5.8	3.5	3.2	4.6	3.0	2.8	4.1
Western Early	8.3	8.9	5.4	6.4	.....	7.0	.....	7.2
Ducona x Mebane 140	9.5	8.0	4.1	4.4	.....	.....	.....	6.5
Ducona x Lone Star	4.3	5.8	4.0	.....	.....	.....	.....	4.7
Mebane 804 x Mebane 140	11.9	10.0	4.5	.....	.....	.....	.....	8.8
Macha	7.1	3.9	5.9	6.0	.....	5.2	11.0	6.5
Ferguson 406	9.7	8.8	4.0	4.0	.....	.....	.....	6.6
Burnett	9.1	11.5	.....	.....	.....	.....	.....	10.3
Ducona x Half and Half	.....	4.9	4.7	.....	.....	.....	.....	4.8
Half and Half x Acala	.....	6.0	5	5.8	.....	.....	.....	4.1
Deltapine	.....	8.2	4.2	6.2	4.7	7.0	3.9	5.7
Mebane 140	.....	6.9	3.6	3.0	.....	.....	2.8	4.1
Shafter x Half & Half x Shafter	.....	.....	5.3	4.0	.....	.....	.....	4.6
Average	7.8	7.1	4.2	4.8	4.6	5.2	4.7	5.8

machine-stripped than from hand-snapped cotton. This is attributed to the machine removing waste in the form of green leaves and parts of limbs which were not present in the hand-snapped cotton.

At Lubbock, there was only 0.7 percent difference in the waste removed from machine-stripped cotton and hand-snapped cotton. It has been stated above that both the machine-stripping and hand-snapping was done soon after the first freeze at Lubbock, and it is reasonable to expect that the amounts of waste collected in the two methods of harvesting would be fairly comparable.

### Grade of Harvested Cottons

Most machine-stripped cotton will be slightly lower in grade than hand-harvested cotton. For comparison, cotton was hand-picked and hand-snapped so that the grade of the lint could be obtained for each, and the grades compared. The cottons harvested by each of the three methods were treated as near the same as possible. That is, all samples were



Table 17. Additional Waste Removed by the Texas Station Cleaner from Samples of Extracted Hand-snapped Cotton at College Station and Lubbock, 1939-1945, in Percentage

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	3.9	5.1	8.9	4.5	4.3	.....	.....	5.3
Mebane 140	3.4	1.9	7.9	3.0	4.4	7.7	.....	4.7
Rogers Acala	4.0	5.0	6.9	5.8	2.5	9.4	.....	5.6
Western Early	4.8	2.6	8.9	5.5	2.8	6.7	3.2	4.9
Deltapine	4.2	4.6	8.5	5.0	2.9	11.4	.....	6.1
Gorhams Lone Star	4.0	4.7	10.8	4.5	5.7	7.7	4.0	5.9
Hi-Bred	3.5	3.3	8.3	4.7	2.8	10.8	.....	5.6
Mebane 804-50	4.4	4.0	7.9	5.6	.....	.....	.....	5.5
Macha	4.2	10.3	6.4	7.1	.....	14.9	3.4	7.7
Ducona 39-10	4.0	3.6	7.3	4.9	.....	.....	.....	5.0
Oklahoma Triumph	.....	.....	9.5	4.0	3.0	7.3	4.8	5.7
Holtz	.....	.....	5.4	4.1	2.3	8.7	.....	5.1
Mebane 804 x Mebane 140	.....	.....	7.8	5.5	3.7	.....	.....	5.7
Stoneville 2B	.....	.....	.....	4.6	4.3	.....	.....	4.4
Roldo Rowden	.....	.....	.....	4.7	3.3	5.9	3.1	4.2
Suntex	.....	.....	.....	4.9	2.4	.....	.....	3.6
Arkansas B-6	.....	.....	.....	.....	4.2	6.8	2.1	4.4
Average	4.0	4.5	8.0	4.9	3.5	8.8	3.4	5.3
Lubbock								
Rogers Acala	6.0	5.3	3.3	.....	.....	.....	.....	4.9
Hi-Bred	5.6	6.5	4.1	5.1	.....	.....	.....	5.3
Western Early	10.2	5.4	4.9	5.1	.....	.....	.....	6.4
Ducona x Mebane 140	5.7	6.6	4.3	5.0	.....	.....	.....	5.4
Ducona x Lone Star	6.2	3.6	3.1	.....	.....	.....	.....	4.3
Mebane 804 x Mebane 140	6.1	7.5	3.7	.....	.....	.....	.....	5.8
Macha	4.8	3.3	5.0	6.5	.....	.....	.....	4.9
Ferguson 406	5.5	5.3	3.1	4.6	.....	.....	.....	4.6
Burnett	8.1	7.8	.....	.....	.....	.....	.....	8.0
Ducona x Half and Half	7.0	4.3	3.7	.....	.....	.....	.....	5.0
Half and Half x Acala	4.6	5.2	2.7	5.2	.....	.....	.....	4.4
Deltapine	.....	5.0	3.7	6.0	.....	.....	.....	4.9
Mebane 140	.....	2.9	3.1	4.6	.....	.....	.....	3.5
Shafter x Half & Half x Shafter	.....	.....	3.5	4.2	.....	.....	.....	3.8
Average	6.3	5.3	3.7	5.1	.....	.....	.....	5.1

cleaned and ginned with the same equipment. Hand-snapped and machine-stripped cottons were extracted with the same equipment.

*Grade of Hand-picked Cotton:* The average grade of hand-picked cotton at College Station was M for all varieties during the seven-year period, 1939-1945, (Table 19). At Lubbock, the average grade for all varieties harvested during a four-year period, 1939-43, was SM—, or 0.9 grade higher than the cottons harvested at College Station. At College Station, 6 of the 17 varieties averaged M, 8 averaged M—, and 3 averaged SLM+. At Lubbock, data are shown for 14 varieties. Of this number, 2 averaged SM+, 5 SM, 2 SM—, 4 M+ and 1 M, with a general average of SM—.

A study of the data in Table 19 reveals that the date of harvest influenced the grade. For example, the average grade for all the varieties tested at College Station during the years 1939, 1940 and 1941, was SM—, M+ and SLM—, respectively. The dates of harvest were September 4, 11 and 30 respectively. This means that in 1940 the cotton was harvested a week later than it was harvested in 1939; that, in 1941, the harvest was two weeks later than in 1940, and three weeks later than in 1939. It is

Table 18. Average Percentage of Additional Waste Removed by the Texas Station Cleaner from Samples of Extracted Cotton for Stripped and Snapped Cotton, College Station and Lubbock, 1939-1945

Variety	Waste removed from extracted seed cotton by cleaner from	
	Machine-stripped cotton	Hand-snapped cotton
College Station		
Regular Ducona.....	8.1	5.3
Mebane 140.....	7.6	4.7
Rogers Acala.....	7.4	5.6
Western Early.....	7.6	4.9
Deltapine.....	8.0	6.1
Gorhams Lone Star.....	8.5	5.9
Hi-Bred.....	8.5	5.6
Mebane 804-50.....	9.1	5.5
Macha.....	8.0	7.7
Ducona 39-10.....	10.6	5.0
Oklahoma Triumph.....	5.8	5.7
Holtz.....	4.8	5.1
Mebane 804 x Mebane 140.....	5.3	5.7
Stoneville 2B.....	8.2	4.4
Roldo Rowden.....	5.3	4.2
Suntex.....	4.4	3.6
Arkansas B-6.....	7.0	4.4
Average.....	7.3	5.3
Lubbock		
Rogers Acala.....	3.9	4.9
Hi-Bred.....	4.1	5.3
Western Early.....	7.2	6.4
Ducona x Mebane 140.....	6.5	5.4
Ducona x Lone Star.....	4.7	4.3
Mebane 804 x Mebane 140.....	8.8	5.8
Macha.....	6.5	4.9
Ferguson 406.....	6.6	4.6
Burnett.....	10.3	8.0
Ducona x Half and Half.....	4.8	5.0
Half and Half x Acala.....	4.1	4.4
Deltapine.....	5.7	4.9
Mebane 140.....	4.1	3.5
Shafter x Half and Half x Shafter.....	4.6	3.8
Average.....	5.8	5.1

noted that as the date of harvest becomes later the grade of the cotton was also lower.

The data for these years at Lubbock when the dates of harvest were progressively later, show the same trend, as the average grades for 1939, 1940 and 1941 were GM—, SM— and M+, respectively.

*Grade of Hand-snapped Cotton:* The average grade for all varieties hand-snapped at College Station was SLM—. This is slightly more than a grade lower than was obtained for the hand-picked cottons. At Lubbock, the grade of the hand-snapped cottons was M, as compared with SM— for hand-picked cotton of the same varieties. Thus, it is seen that the method of harvesting will make a difference in the grade obtained.

The hand-snapped cotton contained more foreign matter and, of course, graded lower. If the averages (Table 25) are compared, it is seen that the average grade for hand-picked cotton was higher than hand-snapped

cotton for all varieties. If the grades of hand-picked and hand-snapped cotton are compared for individual varieties for the same years, it is seen that in a few cases the grade of the hand-snapped cotton was either equal to or better than the grade of hand-picked cotton.

*Grade of Machine-stripped Cotton:* The yearly averages for the grades obtained for the machine-stripped cottons are shown in Table 21. At College Station, the general average for all varieties for the seven-year period was LM+. This is 1.4 grades lower than hand-picked cotton and 0.2 grade lower than hand-snapped cottons. At Lubbock, the general average grade for all varieties machine-stripped was M—, or 0.9 grade lower than hand-picked, and 0.2 grade lower than hand-snapped cottons.

Four varieties at College Station and two varieties at Lubbock show no difference in the average grade between hand-snapped and machine-

Table 19. Grades of Hand-picked Cotton at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	M +	M	LM +	SLM +	M			M—
Mebane 140	SM	M	SLM	SLM	M	SLM		M—
Rogers Acala	SM	M	SLM	M	M		SLM	M—
Western Early	M	SM	LM	SLM	SM	SLM	M	M—
Deltapine	SM	M	SLM	SLM +	M		SLM	M—
Gorhams Lone Star	GM	M	LM	M	M	M	M	M
Hi-Bred	SM	SM	SLM	M	M		SLM	M
Mebane 804-50	SM	LM	SLM	M				SLM +
Macha	SM	SM	LM +	M			SLM	M
Ducona 39-10	M +	M	LM	M				M—
Oklahoma Triumph			LM	M	M +	SLM	SLM +	SLM +
Holtz			LM	M	M	M		SLM +
Mebane 804 x Mebane 140			SLM	SLM	SM			M—
Stoneville 2B				SLM +	M			M—
Boldo Rowden				M	SM	SLM	M	M
Suntex				M	M			M
Arkansas B-6					SM	SLM	M	M
Average	SM—	M +	SLM—	M—	M +	SLM	M—	M
Numerical Average	4.1	4.9	6.5	5.3	4.7	5.7	5.6	5.2
Lubbock								
Rogers Acala	GM	M +	M					SM—
Hi-Bred	GM	SM	M +	M	M			SM—
Western Early	GM	M	M +	SM				SM
Ducona x Mebane 140	SM	SM	M	M				M +
Ducona x Lone Star	GM	M +	SM					SM +
Mebane 804 x Mebane 140	GM	M +	M +					SM
Macha	GM	SM	M	SM				SM
Ferguson 406	SM	M	SLM	M				M
Burnett	GM	M						SM
Ducona x Half and Half	GM	SM	M +					SM +
Half and Half x Acala	GM	SM	SM	M				SM
Deltapine		M +	M +	M	M			M +
Mebane 140		M +	M	M				M +
Shafter x Half & Half x Shafter			SM	M				M +
Average	GM—	SM—	M +	M +	M			SM—
Numerical Average	3.2	4.4	4.7	4.8	5.0			4.3

Table 20. Grade of Hand-snapped Cotton at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	SLM	LM	SGO	SLM	LM			LM
Mebane 140	M+	M	LM	SLM	SLM	LM		SLM
Rogers Acala	M	SLM	SGO	LM	SLM		LM	SLM
Western Early	M-	SLM	LM	SLM	SLM	LM		SLM
Deltapine	M	M	LM	LM	SGO		LM	SLM
Gorhams Lone Star	M	M	SGO	SLM	SGO	SGO	SGO+	LM
Hi-Bred	M+	M	LM	SLM	M		LM+	SLM
Mebane 804-50		M	LM	SLM				SLM
Macha	SLM-	M	SGO	SLM				SLM
Ducona 39-10	M	M	SGO	LM				LM
Oklahoma Triumph			LM	SLM	SLM	LM	LM	SLM
Holtz			LM	SLM	M	SLM		SLM
Mebane 804 x Mebane 140			LM	SLM	SLM			SLM
Stoneville 2B				SGO	SGO			SGO
Roldo Rowden				LM	LM+	SLM	LM+	SLM
Suntex				SLM	SLM+			SLM
Arkansas B-6					SLM	LM	LM	SLM
Average	M-	M-	LM-	SLM-	SLM-	LM+	LM	SLM-
Numerical Average	5.1	5.4	7.4	6.4	6.4	6.7	6.9	6.4
Lubbock								
Rogers Acala	SM	M	SLM	SLM+				M
Hi-Bred	SM	M+	SLM+	SLM+	M			M+
Western Early	M+	SLM+	M	LM				SLM+
Ducona x Mebane 140	M+	M	SLM+	M				M
Ducona x Lone Star	SM	M+	SLM					M+
Mebane 804 x Mebane 140	SM	M	M					M
Macha	SM	SM	LM+	SLM				M
Ferguson	SM	M+	M	SLM+				M
Burnett	SM	SLM+						M+
Ducona x Half and Half	SM	M	SLM					M
Half and Half x Acala	SM	M+	M	M				M+
Deltapine		M	SLM+	SLM+	SLM			SLM+
Mebane 140		M	SLM	M				M
Shafter x Half & Half x Shafter			M	SLM+				M
Average	SM-	M+	SLM+	SLM+	SLM+			M
Numerical Average	4.1	4.8	5.5	5.6	5.5			5.0

stripped cotton. All other varieties show a slightly lower grade for the machine-stripped than for the hand-picked and hand-snapped cotton.

At Lubbock, two varieties had better grades for machine-stripped cotton than for hand-snapped cotton. Three varieties had the same average grade for these two methods of harvest. The average grade for all varieties was SM- for hand-picked, M for hand-snapped and M- for machine-stripped cotton.

#### Staple Length of Harvested Cottons

A comparison of the length of staple for all varieties harvested by hand-picking, hand-snapping and machine-stripping for the seven-year period 1939-1945, is shown in Tables 23, 24 and 25.

*Staple Length of Hand-picked Cotton:* The general average length of staple for the hand-picked cottons at College Station and Lubbock was 28.8/32 and 29.7/32 inch respectively. If the seven varieties that were

Table 21. Grades of Machine-stripped Cotton at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	SLM	SGO	SGO	LM	SLM	SLM	LM	LM
Mebane 140	M	M	SGO	LM	SLM	SLM	LM	SLM
Rogers Acala	SLM	SLM	LM	SLM +	M	SGO +	SGO +	SLM
Western Early	SLM +	LM	SGO	SLM	SLM	SGO +	SGO +	LM +
Deltapine	SLM +	LM	SGO	SLM	LM	SGO	SGO	LM +
Gorbams Lone Star	M	SLM	SGO	SLM	LM +	SGO	GO +	LM +
Hi-Bred	M +	M	LM	SLM +	M	LM	LM	SLM +
Mebane 804-50	SLM +	SLM	SGO	SLM	LM	LM	LM	SLM
Macha	M	LM	SGO	LM	LM	LM	SGO +	LM
Ducona	SLM	M	SGO	LM	LM	LM	LM	LM +
Oklahoma Triumph			LM	LM +	SLM	SLM	SGO	LM +
Holtz			LM	SLM	SLM +	LM	LM	SLM
Mebane 804 x Mebane 140			LM	SLM	LM	LM	LM	LM +
Stoneville 2B				LM	LM	LM	LM	LM
Roldo Rowden				LM	SLM	SLM	SGO	LM +
Suntex				SLM	SLM +	SLM	SGO	SLM +
Arkansas B-6					SLM	SLM	SGO	LM +
Average	M	SLM	SGO +	SLM	SLM	LM +	SGO +	LM +
Numerical Average	5.5	6.2	7.6	6.3	6.0	6.6	7.7	6.6
Lubbock								
Rogers Acala	M +	M +	LM			M	SLM	M
Hi-Bred	SM	M	M		M +	M +	M	M +
Western Early	M	SLM +	SLM	SLM +		M		M
Ducona x Mebane 140	M +	M +	SLM +	SLM +				M
Ducona x Lone Star	GM	M	SLM +					M +
Mebane 804 x Mebane 140	M +	M	SLM					M
Macha	M	M +	LM +	SLM		M	LM	SLM
Ferguson 406	M	M	SLM	SLM +				M
Burnett	M +	SLM +						M
Ducona x Half and Half	M +	M	LM +					M
Half and Half x Acala	SM	M +	M	LM +				M
Deltapine		M	SLM	SLM	SLM	SLM	LM	SLM
Mebane 140		M	M +	SLM +			SLM	M
Shafter x Half & Half x Shafter			SLM	SLM +				SLM +
Average	SM	M +	SLM +	SLM +	M	M	SLM	M
Numerical Average	4.4	4.9	5.8	5.7	5.2	5.1	6.2	5.2

grown at each location are compared, it is found that the staple average is slightly longer for each variety at Lubbock. This was probably because the plats at Lubbock were irrigated and the plants had sufficient moisture for staple growth at the critical time. Hi-Bred produced the shortest staple at both locations, 25.7/32 inch at College Station and 26.6/32 inch at Lubbock. The average length of staple for Rogers Acala was 30.5/32 inch, the longest for a single variety. At Lubbock, Deltapine produced the longest staple, or 31.5/32 inch (Table 23).

*Staple Length of Hand-snapped Cotton:* By comparing the data in Tables 22 and 23, it can be seen that there is no significant difference in the average length of staple for the hand-picked and hand-snapped cottons. For picked cotton, the length of staple for the seven varieties grown at each location was slightly longer at Lubbock than at College Station.

*Staple Length of Machine-stripped Cotton:* The average staple length of machine-stripped cottons harvested at College Station was practically

Table 22. Staple Length of Hand-picked Cotton in 32nd of an Inch at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	32	32	30	30	28			30.4
Mebane 140	28	29	28	28	24	28		27.5
Rogers Acala	33	30	30	30	28		32	30.5
Western Early	29	30	29	30	28	28	33	29.6
Deltapine	32	30	32	30	28		29	30.2
Gorhams Lone Star	30	29	30	30	30	28	30	29.6
Hi-Bred	28	28	26	24	24		24	25.7
Mebane 804-50	29	30	28	28				28.8
Macha	29	28	28	29			26	28.0
Ducona 39-10	30	30	28	31				29.8
Oklahoma Triumph			28	30	28	29	28	28.6
Holtz			29	29	26	28		28.0
Mebane 804 x Mebane 140			26	28	30			28.0
Stoneville 2B				30	30			30.0
Roldo Rowden				30	28	28	30	29.0
Suntex				29	26			27.5
Arkansas B-6					28	28	31	29.0
Average	30.0	29.6	28.6	29.1	27.6	28.1	29.2	28.8
Lubbock								
Rogers Acala	32	31	31					31.3
Hi-Bred	26	29	30	24	24			26.6
Western Early	31	31	31	29				30.5
Ducona x Mebane 140	30	29	32	29				30.0
Ducona x Lone Star	30	32	32					31.3
Mebane 804 x Mebane 140	30	29	30					29.7
Macha	30	26	29	29				28.5
Ferguson 406	30	30	30	28				29.5
Burnett	30	29						29.5
Ducona x Half and Half	31	30	30					30.3
Half and Half x Acala	30	29	29	28				29.0
Deltapine		31	33	29	33			31.5
Mebane 140		28	29	29				28.7
Shafter x Half & Half x Shafter			30	29				29.5
Average	30.0	29.5	30.5	28.2	28.5			29.7

the same as obtained for hand-picked and hand-snapped cottons. The stripped cottons averaged only 0.2 to 0.3 of 1/32 inch shorter than the hand harvested cottons, (Tables 24 and 25). Comparison between varieties show that for 3 of the 17 varieties, the stripped cotton was slightly longer than the hand-picked, and for 6 of the 17 varieties the stripped was slightly longer than the hand-snapped.

At Lubbock, the same trend in staple length prevailed as at College Station. That is, the staple length of hand-picked and hand-snapped averaged slightly longer. The picked averaged 0.8, and the hand-snapped averaged 0.9 of 1/32 inch longer than the stripped cotton. Such a small difference is insignificant and could well be charged to experimental error. At Lubbock, 4 of the 14 varieties of stripped cotton averaged slightly longer than the hand-picked, and 1 variety of stripped cotton averaged slightly longer than the hand-snapped.

This slight and insignificant difference in length of staple obtained for some varieties by each method of harvesting indicates that the fiber was not injured when harvested by the rougher methods.

Table 23. Staple Length of Hand-snapped Cotton in 32nd of an Inch at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	32	29	29	30	30			30.0
Mebane	28	29	30	26	24	26		27.2
Rogers Acala	32	29	28	30	30		29	29.7
Western Early	30	31	30	29	30	28	31	29.9
Deltapine	31	29	30	30	30		29	29.8
Gorhams Lone Star	28	29	29	28	30	31	30	29.3
Hi-Bred	26	26	26	26	20		26	25.0
Mebane 804-50		29	28	28				28.3
Macha	28	26	26	28			26	26.8
Ducona 39-10	30	31	28	29				29.5
Oklahoma Triumph			28	29	28	29	29	28.6
Holtz			29	29	29	29		29.0
Mebane 804 x Mebane 140			28	28	30			28.7
Stoneville 2B				29	30			29.5
Roldo Rowden				29	28	28	29	28.5
Suntex				28	29			28.5
Arkansas B-6					30	28	29	29.0
Average	29.4	28.8	28.4	28.5	28.4	28.4	28.7	28.7
Lubbock								
Rogers Acala	32	33	33					32.7
Hi-Bred	26	28	28	28	24			26.8
Western Early	30	31	31	28				30.0
Ducona x Mebane 140	31	30	29	32				30.5
Ducona x Lone Star	30	32	29					30.3
Mebane 804 x Mebane 140	31	30	30					30.3
Macha	29	29	29	29			28	28.8
Ferguson 406	28	30	30	30				29.5
Burnett	30	30						30.0
Ducona x Half and Half	31	33	30					31.3
Half and Half x Acala	30	30	26	28				28.5
Deltapine		31	30	32	32		32	31.4
Mebane 140		29	28	28			26	28.3
Shafter x Half & Half x Shafter			29	29				29.0
Average	29.8	30.5	29.4	29.3	28.0		28.7	29.8

Mary Anna Grimes<sup>1</sup> studied 84 samples of machine-stripped cotton and found that there is a statistically significant relationship between the grade and the length of the fiber when it was measured in the laboratory; but the relationship between the grade and the length of staple given by the classer is not statistically significant.

### Boll Characteristics

The adaptability of a variety of cotton to machine harvesting is greatly affected by the boll characteristics of the variety. As stated above, in a variety suitable for the stripper type machine, the bolls should be firmly attached to the plant, yet pull off fairly easy; have stormproofness, yet fairly fluffy locks for good extracting; a medium-sized peduncle, and a boll that does not spread wide.

On the other hand, a variety suitable for machine picking should have good stormproofness, fluffy locks, with a high inter-seed fiber drag, fiber

<sup>1</sup>Textile and Clothing Specialist in the Division of Rural Home Research, Texas Agricultural Experiment Station, Unpublished data.

Table 24. Staple Length of Machine-stripped Cotton in 32nd of an Inch at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona.....	30	30	29	28	28	.....	.....	29.0
Mebane 140.....	26	29	26	24	24	26	.....	25.8
Rogers Acala.....	32	31	29	31	29	.....	29	30.2
Western Early.....	29	30	28	30	28	28	28	28.7
Deltapine.....	31	29	29	30	30	.....	28	29.5
Gorhams Lone Star.....	29	30	29	30	28	28	28	28.9
Hi-Bred.....	26	28	26	26	24	.....	26	26.0
Mebane 804-50.....	29	28	28	29	.....	.....	.....	28.5
Macha.....	28	29	26	29	.....	.....	26	27.6
Ducona 39-10.....	30	31	29	29	.....	.....	.....	29.8
Oklahoma Triumph.....	.....	.....	28	30	30	28	26	28.4
Holtz.....	.....	.....	29	29	28	24	.....	27.5
Mebane 804 x Mebane 140.....	.....	.....	28	30	29	.....	.....	29.0
Stoneville 2B.....	.....	.....	.....	31	28	.....	.....	29.5
Roldo Rowden.....	.....	.....	.....	30	29	28	26	28.2
Suntex.....	.....	.....	.....	28	29	.....	.....	28.5
Arkansas B-6.....	.....	.....	.....	.....	28	28	30	28.7
Average.....	29.0	29.5	28.0	29.0	28.0	27.1	27.4	28.5
Lubbock								
Rogers Acala.....	29	31	29	.....	.....	28	28	29.0
Hi-Bred.....	26	28	29	28	26	26	24	26.7
Western Early.....	30	31	30	31	.....	28	.....	30.0
Ducona x Mebane 140.....	30	30	31	30	.....	.....	.....	30.3
Ducona x Lone Star.....	29	30	30	.....	.....	.....	.....	29.7
Mebane 804 x Mebane 140.....	28	29	30	.....	.....	.....	.....	29.0
Macha.....	28	26	29	29	.....	24	28	27.3
Ferguson 406.....	29	29	29	26	.....	.....	.....	28.2
Burnett.....	30	30	.....	.....	.....	.....	.....	30.0
Ducona x Half and Half.....	29	30	28	.....	.....	.....	.....	29.0
Half and Half x Acala.....	29	28	28	24	.....	.....	.....	27.2
Deltapine.....	.....	31	31	29	32	28	30	30.2
Mebane 140.....	.....	28	29	29	.....	.....	26	28.0
Shafter x Half & Half x Shafter.....	.....	.....	31	30	.....	.....	.....	30.5
Average.....	28.8	29.3	29.5	28.4	29.0	26.8	27.2	28.9

long enough to wrap around the picking spindles, wide spreading boll sections and a peduncle that will hold the boll securely so that the machine can remove the cotton.

Considerable data have been collected on the pounds pull necessary to remove bolls from the plant, the degree of boll spread, the length and diameter of the peduncle and the inter-seed fiber drag.

*Pounds Pull to Remove Bolls from the Plant:* On pages 39-44 inclusive of Texas Station Bulletin 580, data are given on the average pounds required to remove cotton bolls from the plant for a four-year period, 1935-1938, at College Station and for a two-year period, 1937-1938, at Lubbock. The general average pull for 23 varieties at College Station was 4.7 pounds, and at Lubbock was 4.6 pounds. This compares fairly close with the average pull for the seven-year period, 1939-1945, when at College Station the average pull for 17 varieties was 3.4 pounds, and at Lubbock for 14 varieties when the average pull was 4.1 pounds (Table 26). The pull for individual bolls ranged from 0 to more than 25 pounds.



Table 25. Average Grade and Staple Length for Hand-picked, Hand-snapped, and Machine-Stripped Cotton at College Station and Lubbock, 1939-1945

Variety	Grade			Staple in 32nd of an inch		
	Hand-picked	Hand-snapped	Machine-stripped	Hand-picked	Hand-snapped	Machine-stripped
College Station						
Regular Ducona	M—	LM +	LM	30.4	30.0	29.0
Mebane 140	M—	SLM +	SLM—	27.5	27.2	25.8
Rogers Acala	M—	SLM—	SLM—	30.5	29.7	30.2
Western Early	M—	SLM—	LM +	29.6	29.9	28.7
Deltapine	M—	SLM—	LM +	30.2	29.8	29.5
Gorhams Lone Star	M	LM +	LM +	29.6	29.3	28.9
Hi-Bred	M	SLM +	SLM +	25.7	25.0	26.0
Mebane 804-50	SLM +	SLM	SLM—	28.8	28.3	28.5
Macha	M	SLM—	LM	28.0	26.8	27.6
Ducona 39-10	M—	SLM—	LM +	29.8	29.5	29.8
Oklahoma Triumph	SLM +	SLM—	LM +	28.6	28.6	28.4
Holtz	SLM +	SLM	SLM—	28.0	29.0	27.5
Mebane 804 x Mebane 140	M—	SLM—	LM +	28.0	28.7	29.0
Stoneville 2B	M—	SGO	LM	30.0	29.5	29.5
Roldo Rowden	M	SLM—	LM +	29.0	28.5	28.2
Sintex	M	SLM +	SLM +	27.5	28.5	28.5
Arkansas B-6	M	SLM +	LM +	29.0	29.0	28.7
Average	M	SLM—	LM +	28.8	28.7	28.5
Lubbock						
Rogers Acala	SM—	M	M—	31.3	32.7	29.0
Hi-Bred	SM—	M +	M +	26.6	26.8	26.7
Western Early	SM	SLM +	M—	30.5	30.0	30.0
Ducona x Mebane 140	M +	M	M	30.0	30.5	30.3
Ducona x Lone Star	SM +	M +	M +	31.3	30.3	29.7
Mebane 804 x Mebane 140	SM	M +	M	29.7	30.3	29.0
Macha	SM	M—	SLM +	28.5	28.8	27.3
Ferguson 406	M	M +	M—	29.5	29.5	28.2
Burnett	SM	M +	M	29.5	30.0	30.0
Ducona x Half and Half	SM +	M	M—	30.3	31.3	29.0
Half and Half x Acala	SM	M +	M	29.0	28.5	27.2
Deltapine	M +	SLM +	SLM	31.5	31.4	30.2
Mebane 140	M +	M—	M	28.7	28.3	28.0
Shafter x Half & Half x Shafter	M +	M—	SLM +	29.5	29.0	30.5
Average	SM—	M	M—	29.7	29.8	28.9

During years when the harvesting date was early in September (Table 1), and there was a low rainfall (Table 2) as in the years 1939, 1940 and 1941, at College Station the pull was higher than in years when the harvest was later, and there was more rain between the time the cotton opened and the date of harvest, as for the years 1943 and 1945 (Table 26).

Generally, the pounds pull necessary to remove bolls from the plant does not show a close relationship between the efficiency of the machine and the boll pull. For example, Regular Ducona at College Station gave the highest pull of all varieties tested (6.4 pounds, Table 26), yet the machine efficiency in harvesting this variety was considerably above the average or 92.2 percent. Other plant characteristics, such as short limbs, large bolls, and medium-sized plant, counteracted the poor, high boll pull characteristics.

At Lubbock, Shafter x Half and Half x Shafter gave a high boll pull and a machine efficiency below the average. Here, the plants were medium to large with numerous long fruiting and vegetative branches.

Table 26. Pounds Pull Required to Remove Bolls from Plants at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	5.2	8.6	5.5	.....	.....	.....	.....	6.4
Mebane 140	3.2	5.2	6.4	3.9	1.6	.....	2.8	3.8
Rogers Acala	2.3	3.7	4.1	3.2	1.2	.....	1.4	2.6
Western Early	2.6	7.1	4.6	2.8	2.2	.....	2.3	3.6
Deltapine	1.3	3.1	3.1	.....	1.1	.....	2.9	2.3
Gorhams Lone Star	3.7	4.9	6.5	.....	.....	.....	2.1	4.3
Hi-Bred	2.2	3.4	2.5	1.6	1.0	.....	1.8	2.1
Mebane 804-50	2.9	5.3	4.8	3.6	.....	.....	.....	4.2
Macha	2.3	3.8	3.8	2.2	.....	.....	4.2	3.3
Ducona 39-40	5.8	5.5	4.1	5.8	.....	.....	.....	5.3
Oklahoma Triumph	.....	.....	2.7	2.1	1.6	.....	2.2	2.2
Holtz	.....	.....	3.9	2.7	1.3	.....	.....	2.6
Mebane 804 x Mebane 140	.....	.....	4.0	3.5	1.5	.....	.....	3.0
Stoneville 2B	.....	.....	.....	2.1	.7	.....	.....	1.4
Roldo Rowden	.....	.....	.....	4.9	1.6	.....	2.8	3.1
Suntex	.....	.....	.....	4.4	2.4	.....	.....	3.4
Arkansas B-6	.....	.....	.....	.....	2.1	.....	5.8	4.0
Average	3.2	5.1	4.3	3.3	1.5	.....	2.8	3.4
Lubbock								
Rogers Acala	2.4	1.9	8.0	.....	.....	3.7	.....	4.0
Hi-Bred	.5	.5	4.6	5.4	3.8	2.9	.....	3.0
Western Early	3.1	1.8	7.5	3.3	.....	4.4	.....	4.0
Ducona x Mebane 140	3.1	1.8	6.8	5.9	.....	.....	.....	4.4
Ducona x Lone Star	4.0	1.7	4.9	.....	.....	.....	.....	3.5
Mebane 804 x Mebane 140	3.2	1.2	8.1	.....	.....	.....	.....	4.2
Macha	1.4	2.6	5.1	5.4	.....	4.9	.....	3.9
Ferguson 406	2.1	2.6	6.8	4.3	.....	.....	.....	4.0
Burnett	6.4	1.6	.....	.....	.....	.....	.....	4.0
Ducona x Half and Half	3.0	1.1	4.3	.....	.....	.....	.....	2.8
Half and Half x Acala	3.4	3.4	7.8	6.2	.....	.....	.....	5.2
Deltapine	.....	1.6	4.7	2.9	3.6	3.1	.....	3.2
Mebane 140	.....	4.2	7.7	3.0	.....	.....	.....	5.0
Shafter x Half & Half x Shafter	.....	.....	9.0	4.4	.....	.....	.....	6.7
Average	3.0	2.0	6.6	4.5	3.7	3.8	.....	4.1

*Degree of Boll Spread:* The data in Table 27 show that the tight-boll stormproof Macha cotton, shown in Figures 8 and 9, has a boll spread of 109.2 and 108.2 degrees for College Station and Lubbock, respectively. As a comparison, Deltapine, which produces a well-opened boll with fluffy locks (Figure 10), has an average boll spread of 118.8 and 126.7 degrees for the two locations, respectively. The field losses for Macha averaged 32 pounds of lint per acre at College Station, and 14.5 pounds at Lubbock. The losses for Deltapine was 24.4 pounds at College Station, and 24.7 pounds of lint per acre at Lubbock (Table 4).

This comparison seems to indicate that there is a relationship between degree of boll spread and field losses in machine harvesting. The data in Table 5, which show storm losses prior to harvest, also indicate, if these two varieties are compared, only that the degree of boll spread has some influence on the amount of cotton shed from the bolls before harvest. The pounds of seed cotton per acre on the ground before harvest at College Station for Macha was 3.1 pounds, and at Lubbock was 2.1 pounds. The

Table 27. Degree of Boll Spread at College Station and Lubbock, 1939-1945

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	118	115	125	130	130	118	123	119.3
Mebane 140	104	117	128	130	130	118	123	121.4
Rogers Acala	110	103	108	104	118	115	149	115.3
Western Early	122	110	128	122	132	115	121	121.4
Deltapine	106	112	122	131	131	123	123	118.8
Gorhams Lone Star	104	111	123	123	123	123	125	117.2
Hi-Bred	110	112	120	122	141	115	115	120.0
Mebane 804-50	110	110	121	117	117	115	115	114.5
Macha	100	125	93	120	120	108	108	109.2
Ducona 39-10	111	111	98	121	121	110	110	110.2
Oklahoma Triumph	132	120	124	116	116	125	123	123.4
Holtz	109	111	104	116	116	110	110	110.0
Mebane 804 x Mebane 140	114	119	136	123	139	132	132	123.0
Stoneville 2B	128	139	139	128	113	105	105	132.5
Roldo Rowden	115	128	113	128	113	105	105	115.2
Suntex	127	124	129	129	123	123	123	125.5
Arkansas B-6	129	123	123	123	123	123	123	126.0
Average	109.5	112.6	117.0	119.5	128.0	117.7	121.6	119.0
Lubbock								
Rogers Acala	105	103	114	132	132	106	106	112.0
Hi-Bred	99	120	129	128	107	132	109	117.7
Western Early	102	115	153	125	143	143	109	127.6
Ducona x Mebane 140	106	114	130	124	143	143	109	118.5
Ducona x Lone Star	104	126	119	124	143	143	109	116.3
Mebane 804 x Mebane 140	107	113	128	124	143	143	109	116.0
Macha	80	103	115	116	127	108	108	108.2
Ferguson 406	106	114	118	117	127	108	108	113.8
Burnett	112	128	128	128	128	128	128	120.0
Ducona x Half and Half	123	124	124	124	124	124	124	123.7
Half and Half x Acala	113	114	126	139	139	139	139	123.0
Deltapine	112	112	114	143	131	146	114	126.7
Mebane 140	113	113	122	120	120	110	110	116.2
Shafter x Half & Half x Shafter	115	115	115	132	132	132	132	123.5
Average	105.2	115.3	123.6	127.1	119.0	136.0	109.4	118.8

loss for Deltapine was 14 pounds at College Station, and 18.6 pounds per acre at Lubbock.

*Length of Peduncle (Boll Stem):* It appears from the data in Table 28 that the length of the peduncle will vary slightly from year to year, and between varieties. It also appears that the amount of moisture available at the time the bolls are set influences the length of the peduncle. For example, at College Station in 1943, no effective rainfall occurred in July and the average length of the peduncle was 0.64 inch, as compared with 0.93 and 0.94 inch in 1939 and 1940 when there were good moisture condition for growth at the critical fruiting stage.

Again, at Lubbock in 1942, when the plot was given several irrigations, the average length of the peduncle was 0.92 inch as compared with the seven-year average of 0.78 inch.

It cannot be said that the length of the peduncle has a significant bearing on the efficiency of the stripper harvester.

Table 28. Length of Peduncle for the Various Varieties Harvested at College Station and Lubbock, 1939-1945, in Inches

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	.96	.94	.98					.96
Mebane 140	.96	.87	.97	.72	.67	.79	.87	.84
Rogers Acala	.99	.88	.87	.71	.65		.72	.80
Western Early	.83	.91	.85	.70	.58	.80	.61	.75
Deltapine	.92	.84	.74		.54		.64	.74
Gorhams Lone Star	1.02	1.08	.95			.66	.69	.88
Hi-Bred	.82	.88	.66	.57	.60		.69	.70
Mebane 804-50	.97	1.00	.76	.84				.89
Macha	.97	1.02	.81	.72			.87	.88
Ducona 39-10	.90	.99	.80	.74				.86
Oklahoma Triumph			.97	.69	.69	.78	.84	.79
Holtz			.75	.65	.44	.64		.62
Mebane 804 x Mebane 140			.88	.68	.89			.82
Stoneville 2B				.65	.45			.55
Roldo Rowden				.93	.70	.88	.93	.86
Suntex				.72	.73			.72
Arkansas B-6					.69	.86	1.00	.85
Average	.93	.94	.85	.72	.64	.77	.79	.79
Lubbock								
Rogers Acala	.71	.66	.75			.89	.80	.76
Hi-Bred	.65	.58	.61	.93	.62	.65	.70	.68
Western Early	.72	.64	.76	.66		.70		.70
Ducona x Mebane 140	.83	.76	.83	.88				.82
Ducona x Lone Star	.85	.66	.94					.82
Mebane 804 x Mebane 140	.82	.86	.79					.82
Macha	.64	.62	.74	.88		.70	.60	.70
Ferguson 406	.81	.74	.80	1.06				.85
Burnett	1.00	.66						.83
Ducona x Half and Half	.77	.66	.67					.70
Half and Half x Acala	.76	.64	.69	.89				.74
Deltapine	.64	.88	.80	.84	.78	.78	.70	.77
Mebane 140		.76	.69	1.02			.70	.79
Shafter x Half & Half x Shafter			.77	1.16				.96
Average	.77	.70	.76	.92	.70	.74	.70	.78

*Diameter of the Peduncle (Boll Stem):* As with the length, the diameter of the peduncle varies slightly from year to year, and between varieties. There is no significant difference between the general average for the two locations, as the average diameter at College Station was 0.083, and at Lubbock 0.081 inch (Table 29). There is some indication that the diameter of the peduncle has an influence on the pounds pull required to remove the boll from the plant. The diameter of the peduncle for Ducona averaged 0.10 inch, and the pull was high with 6.4 pounds (Table 30). The average pull for Shafter x Half and Half x Shafter was 6.7 pounds, and the average diameter of the peduncle was 0.09 inch.

The peduncle for Hi-Bred at Lubbock averaged 0.07 inch, and the pull was 3 pounds. At College Station, however, Hi-Bred and Deltapine had peduncles averaging 0.07 inch, and the pull was 2.1 and 2.3 pounds, respectively.

Table 29. Diameter of Peduncle of Bolls at College Station and Lubbock, 1939-1945, in Inches

Variety	1939	1940	1941	1942	1943	1944	1945	Ave.
College Station								
Regular Ducona	.10	.11	.10					.10
Mebane 140	.09	.10	.08	.08	.08	.08		.08
Rogers Acala	.09	.09	.09	.09	.08			.09
Western Early	.07	.09	.08	.07	.07	.07		.08
Deltapine	.07	.09	.05		.07			.07
Gorhams Lone Star	.09	.10	.10			.08		.09
Hi-Bred	.08	.09	.05	.07	.08			.07
Mebane 804-50	.08	.09	.07	.08				.08
Macha	.08	.10	.09	.08				.09
Ducona 39-10	.09	.09	.08	.09				.09
Oklahoma Triumph			.08	.08	.08	.08		.08
Holtz			.09	.08	.08	.08		.08
Mebane 804 x Mebane 140			.08	.08	.08			.08
Stoneville 2B				.08	.08			.08
Roldo Rowden				.09	.09	.08		.09
Suntex				.08	.08			.08
Arkansas B-6					.08	.07		.08
Average	.08	.09	.08	.08	.08	.08		.083
Lubbock								
Rogers Acala	.09	.08	.09			.08	.07	.08
Hi-Bred	.07	.07	.08	.09	.07	.07	.06	.07
Western Early	.08	.08	.08	.08		.07		.08
Ducona x Mebane 140	.08	.08	.09	.10				.09
Ducona x Lone Star	.09	.08	.08					.08
Mebane 804 x Mebane 140	.08	.07	.08					.08
Macha	.08	.07	.08	.09		.07	.06	.08
Ferguson 406	.08	.08	.09	.09				.08
Burnett	.08	.08						.08
Ducona x Half and Half	.09	.08	.08					.08
Half and Half x Acala	.09	.08	.08	.09				.08
Deltapine		.08	.08	.08	.07	.07	.07	.08
Mebane 140		.08	.09	.10				.08
Shafter x Half & Half x Shafter			.08	.10				.09
Average	.08	.08	.08	.09	.07	.07	.07	.081

Table 30. Boll Characteristics for Varieties Harvested at College Station and Lubbock, 1939-1945

Variety	Pull to remove boll from plant (pounds)	Boll spread (degrees)	Peduncle	
			Length (inches)	Diameter (inches)
College Station				
Regular Ducona.....	6.4	119.3	.96	.10
Mebane 140.....	3.8	121.4	.84	.08
Rogers Acala.....	2.6	115.3	.80	.09
Western Early.....	3.6	121.4	.75	.08
Deltapine.....	2.3	118.8	.74	.07
Gorhams Lone Star.....	4.3	117.2	.88	.09
Hi-Bred.....	2.1	120.0	.70	.07
Mebane 804-50.....	4.2	114.5	.89	.08
Macha.....	3.3	109.2	.88	.09
Ducona 39-10.....	5.3	110.2	.86	.09
Oklahoma Triumph.....	2.2	123.4	.79	.08
Holtz.....	2.6	110.0	.62	.08
Mebane 804 x Mebane 140.....	3.0	123.0	.82	.08
Stoneville 2B.....	1.4	132.5	.55	.08
Roldo Rowden.....	3.1	115.2	.86	.09
Suntex.....	3.4	125.5	.72	.08
Arkansas B-6.....	4.0	126.0	.85	.08
Average.....	3.4	119.0	.79	.083
Lubbock				
Rogers Acala.....	4.0	112.0	.76	.08
Hi-Bred.....	3.0	117.7	.68	.07
Western Early.....	4.0	127.6	.70	.08
Ducona x Mebane 140.....	4.4	118.5	.82	.09
Ducona x Lone Star.....	3.5	116.3	.82	.08
Mebane 804 x Mebane 140.....	4.2	116.0	.82	.08
Macha.....	3.9	108.2	.70	.08
Ferguson 406.....	4.0	113.8	.85	.08
Burnett.....	4.0	120.0	.83	.08
Ducona x Half and Half.....	2.8	123.7	.70	.08
Half and Half x Acala.....	5.2	123.0	.74	.08
Deltapine.....	3.2	126.7	.77	.08
Mebane 140.....	5.0	116.2	.79	.08
Shafter x Half and Half x Shafter.....	6.7	123.5	.96	.09
Average.....	4.1	118.8	.78	.081

Table 31. Inter-seed Fiber Drag in Grams for Varieties Used in Harvesting Tests at College Station and Lubbock, 1941-1945

Variety	1941	1942	1943	1944	1945	Ave.
College Station						
Regular Ducona	163		66			114
Mebane 140	204	154	103	116		144
Rogers Acala		175	175			175
Western Early	168	135	99	115		129
Deltapine			97			97
Gorhams Lone Star	190		60	93		114
Hi-Bred		253	212			232
Mebane 804-50		175				175
Macha		175				175
Ducona 39-10		150				150
Oklahoma Triumph		150	67	99		105
Holtz		200	76	81		119
Mebane 804 x Mebane 140		100	89			94
Stoneville 2B		175	94			134
Roldo Rowden		175	137	139		150
Suntex		100	100			100
Arkansas B-6			101	116		108
Average	181	163	105	108		136
Lubbock						
Rogers Acala				233	147	190
Hi-Bred		238	228	401	272	285
Western Early		176		258		217
Ducona x Mebane 140						
Ducona x Lone Star						
Mebane 804 x Mebane 140						
Macha		200		271	212	228
Ferguson 406		136				136
Burnett						
Ducona x Half and Half						
Half and Half x Acala		176				176
Deltapine		115	128	199	186	157
Mebane 140		161		248	208	206
Shafter x Half and Half x Shafter		160				160
Average		170	178	268	205	195

### Inter-seed Fiber Drag

During the five-year period, 1941-1945, some data were obtained on the inter-seed fiber drag. That is, the number of grams pull required to pull apart and separate seeds in a lock of cotton. Figure 14 shows the special-made gram scales used in determining the inter-seed fiber drag.

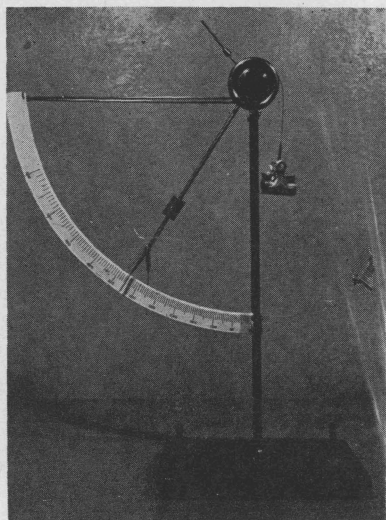


Figure 14. Apparatus developed to determine the inter-seed fiber drag.

short staple cottons come from the cleaner separately with the fiber standing out radially from the seed, while with the longer staple all the seeds do not separate and there is a greater tendency for the fiber between the seeds to twist and "rope" during the cleaning operation.

The data in Table 31 show that there was considerable variation in the drag when varieties are compared. General trend indicates that the short staple cottons have the strongest drag, while the longer staple cottons have the lowest drag. For example, at Lubbock, Hi-Bred had the shortest staple (26.7/32 inch) of all the varieties (Table 25), yet it had the strongest inter-seed fiber drag (Table 31). At College Station, the average drag was 232 grams and at Lubbock 285 grams, as compared with Rogers Acala which had an average staple length of approximately 30/32 inch, and an inter-seed fiber drag of 175 grams at College Station and 190 grams at Lubbock.

When the grade is considered, it appears that the short staple cottons clean better than the longer staple cottons. The individual seed for the

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## SUMMARY AND CONCLUSIONS

The data presented in this bulletin give results of tests conducted at College Station and Lubbock during the seven-year period, 1939-1945, to determine the factors affecting the performance of mechanical cotton strippers, extractors and cleaners.

Numerous commonly grown varieties, and new strains of cotton developed by means of selection, crossing and backcrossing were tested for their varietal reaction to machine harvesting, extracting and cleaning.

Complete data are given for 17 varieties at College Station and 14 varieties at Lubbock.

The performance or efficiency of the stripper harvester varied from year to year and for the various varieties harvested each year. The average efficiency of the stripper harvester at Lubbock and College Station was 96.4 and 89.0 percent respectively, or a difference of 7.4 percent for the two locations. At College Station, there was a difference of 9.3 percent in machine performance between varieties, while at Lubbock the difference between the best and poorest varieties was 6.8 percent. These differences may be attributed largely to differences in varietal characteristics, such as size and type of plants, stormproofness and fluffiness of the cotton.

At College Station under normal conditions, the average loss by the stripper amounted to 19.2 pounds (1945 data excluded) of lint per acre or at 25 cents per pound, \$4.80 per acre, and at Lubbock to 8.4 pounds (1942 data excluded) of lint or \$2.10 per acre.

The average acre yield of lint cotton for all varieties at Lubbock was 406 pounds, in comparison with 224 pounds at College Station.

The average plant height at College Station was 28.6 inches, while at Lubbock for early irrigated cotton the average height was 22.2 inches.

Tall, branchy, wide spreading plants materially affected the performance of the stripper, causing severe losses.

Varietal characteristics, such as stormproofness and staple length combined with a compact lock and yield are important factors that cause excessive losses in extracting cotton.

At College Station, an average of 34.1 percent of all the material harvested by the stripper was removed by the extractor as burs and waste, while at Lubbock the percentage was 28.7. The larger amount of waste at College Station can be attributed to a large extent to the condition of the plants at the time of harvest.

There was little difference in the percentage of burs and waste removed from machine-stripped cotton and hand-snapped cotton. At College Station, the average percentages of burs and waste removed from machine-stripped and hand-snapped cotton were 34.1 and 35.1 percent, respectively, while at Lubbock the averages were 28.7 and 28.6 percent, respectively.

The average percentage of waste removed from extracted machine-stripped and hand-snapped cotton did not vary greatly between the two locations. There was, however, considerable difference in the percentages of waste removed when varieties are compared. This apparently reflects the cleaning qualities of different varieties.

The average grade for hand-picked, hand-snapped and machine-stripped cotton at College Station was middling, strict low middling minus, and low middling plus, respectively. At Lubbock, the average grades were strict middling minus, middling and middling minus, respectively. The grade of the machine-stripped cotton was definitely affected by condition of the plants at the time of harvest.

Method of harvesting had no significant effect on staple length.

A variety of cotton suitable for machine-stripping should have bolls firmly attached to the plant, yet pull off fairly easy; have stormproofness, but fairly fluffy locks for good extracting; and have a medium-sized peduncle and a boll that does not spread wide.

A variety suitable for machine-picking should have good stormproofness, fluffy locks, with a high inter-seed fiber drag; fiber long enough to wrap around the picking spindles, and a peduncle that will hold the boll securely so that the machine can remove the cotton.

The average pull required to remove cotton bolls from plants of all varieties at College Station was 3.4 pounds, while at Lubbock the average was 4.1 pounds.

The average degree of spread of boll sections at College Station ranged from 109.2 degrees for Macha to 132.5 degrees for Stoneville 2B. At Lubbock, the range was from 108.2 degrees for Macha to 127.6 degrees for Western Early. The data indicate that there is a relationship between the degree of boll spread and the field losses in machine harvesting.

The length and diameter of the boll peduncle apparently did not affect machine field losses.

Inter-seed fiber drag was highest for the short staple varieties and lowest for the long staple varieties.