DRYING AND CLEANING COTTON AT THE GIN

Effect on Fiber Properties and Spinning Performance San Joaquin Valley, 1959–60

Marketing Research Report No. 710

Agricultural Research Service
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This report is based on an unpublished analysis of covariance made on test data obtained from cotton grown in the Kern Delta of the San Joaquin Valley in California. The analysis was made by the Department of Textile Technology, School of Textiles, North Carolina State College, under contract RMS 12–25–010–2642 between the U.S. Department of Agriculture and North Carolina State College, Raleigh, N.C.

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SUMMARY AND CONCLUSIONS

This study is one in a series designed to determine the effect of various harvesting and ginning practices on cotton quality, market value, and manufacturing performance. Results suggest that excessive drying usually reduces bale values, and that the use of lint cleaners generally increases returns only moderately or not at all if grade-differential prices are narrow. Moreover, drying within narrow limits—as practiced in this study—and lint cleaning affect quality of lint adversely, resulting in weaker and lower grade yarns.

The study consisted of analyzing the fiber from 54 bales of mechanically harvested Acala 4–42 cotton grown in the Kern Delta near Bakersfield, Calif. Ginning conditions in the test consisted of: (a) three lint moisture target levels—5, 4, and 3 percent; (b) elaborate [1] and moderate seed cotton cleaning equipment; and (c) none, one, and two lint cleaners.

The seed cotton used in this test was harvested and ginned early in October. It was harvested during the day when relative humidity was stabilized. Foreign matter in the cotton averaged approximately 6.5 percent; fiber moisture was about 7 percent as the cotton reached the gin. This low moisture level of the seed cotton made it impossible to gin cotton at the 5-percent target level. This was impossible even when no artificial heat was used in the drier, because relative humidity was low, ambient air temperature was high, and air changes occurred several times in the ginning system.

The use of elaborate seed cotton cleaning compared with moderate cleaning had no effect on grade, fiber properties, or spinning performance.

Results of the current study showed that lint grade was improved through the use of lint cleaners. Each stage of lint cleaning resulted in an increase of about a one-half grade. However, drying, or reducing the lint moisture from 5 to 3 percent, did not significantly improve the grade in this test. Regardless of the amount of drying or seed cotton cleaning employed, maximum lint grades were obtained whenever two lint cleaners were used.

Without considering differences in ginning costs associated with the different practices and after adjusting for weight losses due to drying and cleaning, net bale values were always reduced by drying regardless of the amount of lint cleaning used. This loss averaged about $4.50 per bale, based on either 1959 or 1961 premiums and discounts. At a lint moisture level of 4.9 percent, which was achieved largely without any artificial heat and by the use of relatively wide price differences of 1959, the first lint cleaner increased the net bale value to the grower by $0.83. The second lint cleaner increased net bale value by an additional $1.29.

In 1961 when price differences were narrow, the price per pound was increased for the grower by using lint cleaners, but net bale values were not increased to any extent by using lint cleaners.

Generally, reducing lint moisture by 1 percentage point through drying had the following effects:

1. In ginned lint, it reduced mean length (Suter-Webb array) by more than 0.01 inch, it increased the coefficient of variation by 1 percentage point, and it increased short fiber content by three-quarters of a percentage point. In card sliver, this adverse effect was much greater. Reducing lint moisture by 2 percentage points increased the short fiber in ginned lint by almost 17 percent and in card sliver, 24 percent.
2. Yarn strength was reduced by 71 break-factor units, or 3 percent.
3. Yarn appearance was adversely affected.

The use of lint cleaners had about the same adverse effect on length and length distribution measurements as did reducing lint moisture by 1 percentage point, and the effect of each lint cleaner was about equal. The second lint cleaner was responsible for the decrease in yarn strength.

Test results indicate that once cotton lint has been dried to a low level, any manipulation of the fiber, whether in ginning or in manufacturing, results in fiber breakage.

Lint cleaning and drying had significant effects on the presence of foreign matter in ginned lint, and were reflected in mill processing waste. However, the content of foreign matter in the card sliver was equal for all cleaning conditions, indicating that any differences in foreign matter originally present were removed through normal mill cleaning operations.

Regardless of the number of lint cleaners used, drying during ginning usually slightly reduced the cost per pound of "clean" cotton to mills. Regardless of the amount of drying, the use of lint cleaners generally increased the cost per pound of "clean" cotton to the mills. The slightly lower cost due to drying was partially offset and the higher cost due to lint cleaning was further increased by the weaker and poorer grade of yarn made from lint that had been subjected to these ginning practices.

These results suggest that recent premiums that could be obtained from cleaning cotton in the Strict Low Middling or Middling grades are excessive because foreign matter is eventually removed by mills in the normal course of manufacturing.

[1] Elaborate seed cotton cleaning consisted of 23 cylinders of cleaning and a master bur extractor; moderate seed cotton cleaning consisted only of 16 cylinders of cleaning.

DRYING AND CLEANING COTTON AT THE GIN: Effect of Fiber Properties and Spinning Performance, San Joaquin Valley, 1959–60

By Victor L. Stedronsky, *Agricultural Engineering Research Division, Agricultural Research Service;* John E. Ross, *Economic Research Service;* and Edward H. Shanklin, *Market Quality Research Division, Agricultural Research Service*

INTRODUCTION

Producers and ginners of cotton in the San Joaquin Valley of California are very much aware of the necessity to strive for maximum quality in growing, harvesting, ginning, and marketing their product. As in other parts of the Cotton Belt, producers and ginners are also acutely aware of the need to realize maximum net returns per acre, consistent with the preservation of basic cotton quality.

Favorable weather throughout most of the year causes growers in the San Joaquin Valley to be conscious of the effect of moisture on the harvesting of cotton as well as moisture's subsequent effect on the quality of cotton after it is ginned. Previous studies of cotton grown in the San Joaquin Valley indicated that ambient air used in moving cotton through the ginning system had an important effect in reducing moisture in the ginned lint.[2] Ambient air often reduced lint moisture to levels below those recommended for the preservation of the lint quality, particularly if the percentage of moisture in seed cotton was abnormally low.

However, producers and ginners recognize that artificial drying facilitates the removal of foreign matter by gin cleaners and thus may contribute to grade improvement. Because they are quality conscious, many industry leaders in this area have been concerned with the effect of drying on cotton quality, particularly when the initial moisture level is low. They are particularly concerned because (1) the U.S. Department of Agriculture recommends that cotton be dried to not less than 5 percent lint moisture, and (2) atmospheric conditions in the far western part of the Cotton Belt frequently are low and cause ginned lint to contain less than the recommended amount of moisture, even when no artificial drying is used in ginning. For these reasons more precise information is needed on how drying to several levels of moisture in arid conditions might affect grade, bale value, fiber quality, and spinning performance.

Industry leaders in this area also requested that different amounts of lint cleaning and overhead seed cotton cleaning be applied when testing the effects of various levels of moisture on cotton quality.

[2] Ross, John E., Leonard, Clarence G., and Shanklin, Edward H., *Cotton Fiber and Spinning Properties as Affected by Certain Ginning Practices in San Joaquin Valley, Calif., season 1958–59.* U.S. Dept. Agr. Market. Res. Rpt. No. 486, 24 pp. 1961.

EXPERIMENTAL PROCEDURE

Harvesting

The seed cotton used in this test was grown commercially in a 30-acre field 13 miles south of Bakersfield, Calif. It was grown by the cultural practices commonly used in that area. Cotton plants were 3½ to 5 feet tall and had been chemically defoliated 14 days before cotton was picked. Defoliation was judged to have been 50 to 80 percent effective.

The field was harvested by use of two new Rust [3] spindle pickers with picking units in tandem. Machine adjustments were checked each morning, and operations were observed throughout the test

[3] Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

by representatives of the manufacturer. Machines were cleaned after each day's harvest, and trash was removed from the picking heads and basket every four rounds. All the picking was supervised by harvesting research personnel of the U.S. Cotton Field Station, Shafter, Calif.

Eighteen bales of test cotton were harvested on each of 3 consecutive days making a total of 54 bales. Each test lot consisted of 1 full bale. Warm, sunny conditions prevailed throughout the harvest period. Temperature was normal for the time of year and was in the vicinity of 80° F. Picking data for the stated dates were as follows:

	Seed cotton harvested—pounds	*Relative humidity—percent*
Oct. 5, 9 a.m. to 4 p.m.	30, 610	40–30
Oct. 6, 9 a.m. to 2 p.m.	29, 780	52–45
Oct. 7, 8:30 a.m. to 2:30 p.m.	30, 760	65–48

Ginning

The ginning was conducted at the Kern Delta Cooperative Gin, a modern commercial 5-stand plant equipped with two stages of lint cleaning. The regular crew did the ginning. Normal operating practices were used except where machinery was bypassed or added to the line to satisfy test requirements. Slightly more than 9 pounds of lint per saw per hour was ginned during actual operations. Cotton was given the following treatment during ginning:

A. Three levels of lint cleaning—no lint cleaner, one lint cleaner, and two lint cleaners.

B. Elaborate and moderate overhead seed cotton cleaning setups.

C. Drying the lint to target levels of 5-, 4-, and 3-percent moisture.

There were 18 specific gin treatments, each treatment was replicated 3 times, and each treatment required a bale of cotton. Consequently, a total of 54 bales of cotton was used in the series of tests. Arrangement of ginning equipment is shown in figure 1. Drier temperatures were controlled by adjusting the flame manually to obtain the desired target moisture of the ginned lint. Thus, when the driers were used, the burner flame was constant and did not fluctuate on-and-off as it does in the normal operation of a drier. An electrical-resistance moisture meter was used constantly to obtain moisture readings at the lint slide. Burner flames in the drier were adjusted to dry the lint as nearly as possible to target moisture levels. Drier inlet and outlet temperatures are shown in table 1.

Gin machinery was arranged so that all seed cotton passed through both driers. In many instances, even when no artificial heat was applied, lint moisture was reduced to less than the 5-percent target. Ambient air in October and low relative humidity can remove considerable moisture from cotton, especially when it is subjected to six changes of air during the time it is removed from the trailer, is ginned, and has arrived at the press. Ambient conditions on the dates of ginning were as follows:

	Gin temperature—° F.	*Gin relative humidity—percent*
Oct. 6, 10 a.m. to 3:30 p.m.	70–80	40–32
Oct. 7, 9 a.m. to 3 p.m.	65–82	50–34
Oct. 8, 9:30 a.m. to 2 p.m.	68–84	56–30

Seed cotton used in the test was very homogeneous when it came from the field. This is evident from the fact that foreign matter for the three replications ranged from 6.3 to 6.6 percent. Fiber moisture for the three replications ranged from 6.5 to 7.8 percent as seed cotton reached the gin.

This moisture content was considered to be most favorable for test purposes and is typical of cotton harvested in the area at that time of year. Regardless of the cleaning treatment given the seed cotton, it contained the same amount of foreign matter when it reached the gin stands—1.3 percent.

Fiber Tests

After removal of the bale ties and before spinning, the cotton was sampled in several places throughout the bale for fiber and moisture tests. One sample was also taken from the card sliver of each lot. Samples were mechanically blended, and each was subjected to the Suter-Webb array, Fibrograph, Micronaire, and "0" and ⅛-inch gage Pressley strength tests.

Spinning Tests

A spinning test consisted of spinning a full doff of 40s yarn. This required 8 hours of continuous frame operation, or 8,064 spindle hours. All 40s yarn was spun from single creel 1.25 hank roving using a twist multiplier of 4.25 and a spindle speed of 11,000 r.p.m. It had been planned to spin 30s yarn with a twist multiplier of 4.25. However, the ends-down level for the first lots spun was only 10 per thousand spindle hours; therefore, spinning of the coarser 30s yarn was abandoned.

With the bale ties removed, each bale was conditioned for 24 hours in the opening room prior to processing. Each 1-bale spinning lot was processed through the opening and picking line, which consisted of two blender-feeders, a lattice opener, a hopper feeder, and a picker equipped with a blade beater and a Kirschner beater. The cotton fed to the opening line, the cotton delivered by the picker, and the waste removed at each beater section were weighed. The 14-ounce picker laps produced at the picker were delivered to the card room and conditioned at least 12 hours before carding.

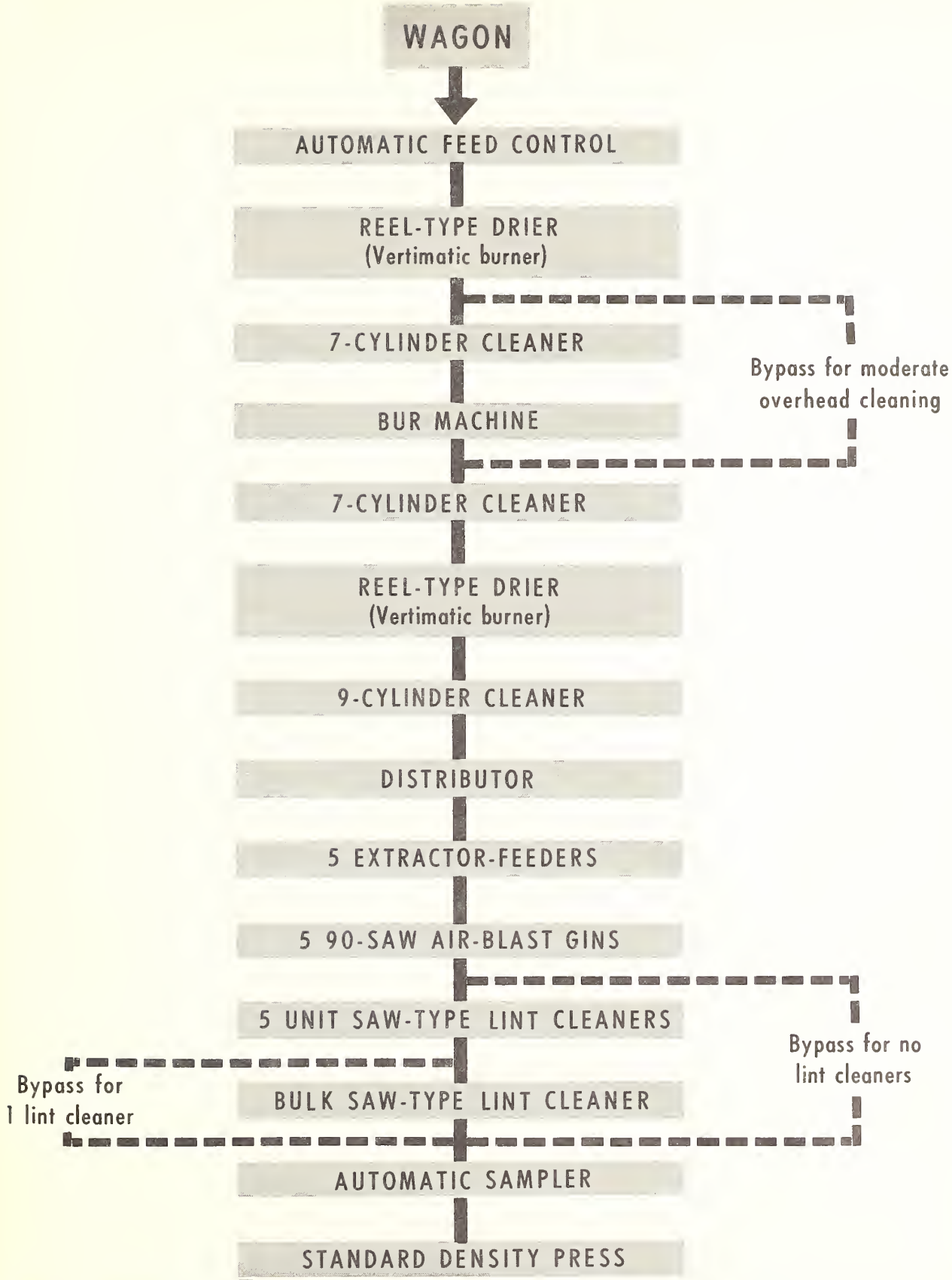

FIGURE 1.—Equipment used in the Kern Delta Cooperative Gin, Bakersfield, Calif., for the 54-bale ginning study of cotton grown in the San Joaquin Valley, crop of 1959.

TABLE 1.—*Gin drying temperatures and lint moisture data—season 1959–60*

[For cotton grown in the Kern Delta, Calif.]

Replication	Lint moisture target	Actual moisture at lint slide	Overhead seed cotton cleaning setup	Lot No.	Lint cleaners	Drying air temperature				Lint moisture	
						1st drier		2d drier		Roller-ginned from trailer	Lint slide
						In	Out	In	Out		
	Percent	*Percent*			*Number*	*° F.*	*° F.*	*° F.*	*° F.*	*Percent*	*Percent*
I	3	3.27	Moderate	1	0	275	204	160	150	6.65	3.05
				2	1	280	198	164	150	5.78	3.25
				3	2	285	200	165	153	6.35	3.18
			Elaborate	4	1	262	201	160	150	5.02	3.18
				5	0	249	190	150	140	5.67	3.57
				6	2	285	239	155	145	6.40	3.37
I	5	4.52	Moderate	7	2	150	131	90	99	5.75	4.30
				8	0	90	90	90	91	6.43	4.60
				9	1	89	89	90	91	5.80	4.50
			Elaborate	10	0	90	89	90	90	7.92	4.78
				11	1	89	89	90	90	5.58	4.30
				12	2	89	88	90	90	6.32	4.67
I	4	4.40	Moderate	13	2	155	119	90	91	5.83	4.53
				14	1	175	135	91	95	5.85	4.25
				15	0	214	160	91	99	5.75	4.10
			Elaborate	16	1	195	150	90	95	7.83	4.22
				17	0	194	148	92	95	8.52	4.83
				18	2	195	148	91	94	8.45	4.48
II	5	5.40	Moderate	19	2	75	90	79	85	7.50	5.75
				20	1	130	110	80	85	7.32	5.40
				21	0	132	110	81	85	7.57	5.65
			Elaborate	22	2	135	110	85	85	7.87	5.22
				23	1	145	119	85	86	7.48	5.10
				24	0	155	121	88	89	6.80	5.30
II	4	4.19	Moderate	25	2	268	185	87	91	7.05	4.27
				26	0	267	210	90	99	6.77	4.13
				27	1	210	160	90	98	6.28	4.22
			Elaborate	28	2	219	160	90	95	6.50	4.28
				29	1	235	160	90	92	6.73	4.00
				30	0	180	161	91	92	6.65	4.23
II	3	3.46	Moderate	31	2	291	205	170	131	6.25	3.45
				32	0	300	203	190	160	6.77	3.48
				33	1	285	220	179	160	6.88	3.17
			Elaborate	34	0	220	171	178	151	5.92	3.40
				35	1	199	160	145	140	6.30	3.57
				36	2	200	155	140	131	6.27	3.67
III	4	4.22	Moderate	37	1	241	181	87	91	7.53	4.13
				38	2	238	180	89	92	7.23	4.20
				39	0	235	177	90	95	6.43	4.15
			Elaborate	40	2	218	159	89	91	7.37	4.32
				41	1	220	161	90	91	7.23	4.22
				42	0	202	160	90	91	7.45	4.27
III	3	3.37	Moderate	43	0	312	203	225	180	8.00	3.55
				44	2	315	211	235	191	7.05	3.10
				45	1	300	205	181	162	10.57	3.47
			Elaborate	46	2	298	201	185	161	8.27	3.22
				47	1	300	245	195	180	10.12	3.55
				48	0	305	220	200	180	8.73	3.35
III	5	4.14	Moderate	49	0	150	100	98	105	7.72	4.57
				50	2	93	95	95	95	7.08	4.58
				51	1	95	91	97	97	7.67	4.67
			Elaborate	52	2	93	90	95	95	6.53	4.57
				53	1	95	90	97	97	7.73	4.67
				54	0	94	90	97	97	7.73	4.75

A 50-grain sliver was produced at the card at the production rate of 9½ pounds per hour. Samples of the card web were taken on three nep boards at four different times during the carding operation. Separate nep counts were made by two technicians on each of the 12 nep boards for each lot. The card was stripped and cleaned after processing each lot, and the waste was weighed.

A 53-grain sliver was produced at the first drawing process with an operating speed of 265 f.p.m. from 8 ends of card sliver. A 55-grain sliver was produced at the second drawing process from 8 ends of first drawing sliver.

At the roving process, 1.25 hank roving was produced from single, second-drawing sliver by use of a 1.30 twist multiplier and a spindle speed of 900 r.p.m

Roving was creeled singly into four 252-spindle spinning frames. New travelers were used for each spinning doff, and the frames were run for 30 minutes to break in the travelers and to obtain yarn for sizing. Draft gears were changed if necessary to obtain the specified yarn size. Ends down were recorded at 15-minute intervals during the spinning of a full doff of yarn, which ran 8 hours for 40s.

All the yarn was spun at a spindle speed of 11,000 r.p.m. on rings 2 inches in diameter. Standard yarn size tests, skein strength tests, and appearance tests were made on each doff of yarn. Throughout the tests, the card room and spinning room were maintained at a temperature of 75° F. and a relative humidity of 55 percent.

ANALYSIS PROCEDURE

Original Plan

This study was originally designed to have a complete set of factorial treatments laid out in a split-plot design, which is generally appropriate for field experiments. To maintain a valid factorial structure, the factorial levels need to be effectively controlled throughout the study. In this study, two of the factors—lint cleaning and the setup of overhead seed cotton cleaning—were easily controlled. The third factor—lint slide moisture—was difficult to control at the 3-, 4-, and 5-percent target levels desired. Some overlapping occurred at the 4- and 5-percent moisture levels, and wide variations occurred within each nominal level.

Figure 2 shows the levels of lint slide moisture attained. The overlapping at 4- and 5-percent moisture levels in replication 1 is shown in table 1.

The grouping of such moisture data into nominal factorial levels would result in additional uncontrolled variation, and the treatment comparison for the factor—lint slide moisture—would be meaningless. In addition, depending on the pattern or scatter of the actual moisture levels around the target moisture levels, interactions may reflect false conclusions and may hardly be assessable with reasonable physical meaning. The significance of the three-term interaction—lint slide moisture × overhead cleaners × lint cleaners—as detected in a split-plot analysis appears to be mere consequence of such false indications. Effective interpretation of interactions requires that the experiment be precisely controlled. The inability to hold lint slide moisture within close tolerances of the target levels made it necessary to revise the analysis procedure.

Revised Plan

To remedy the situation, a covariance analysis was carried out by regarding lint slide moisture as a covariate, or a continuous variable, associated with original split-plot structure. The use of lint slide moisture was introduced as a covariate with the assumption that any interactions between lint slide moisture and the other factors were not of significant magnitude. Statistical analysis supported this assumption.

In addition, a consideration of the error levels that would be estimated if the target levels were considered as blocks within the replications of the experiment showed them to be equivalent. On this basis, the lint cleaner and overhead cleaning treatments were considered as randomly assigned within each replication, and the observed lint moisture was treated as a covariate.

The assumption of the moisture levels to be a covariate further implies that within each classification (lint cleaner and overhead cleaner setups) the observations can be estimated by a linear relation in the form of

$$y=a+bx,$$

where x is the moisture level.

EXPERIMENTAL RESULTS

Interaction Between Lint Cleaners and Seed Cotton Cleaners

Comparisons of treatment means for interaction between lint cleaners and overhead seed cotton cleaners were minor and not statistically significant in most instances (app. tables 5, 6, and 7).

Normally in a study of this type, the interaction of drying and lint cleaning may be expected to show significance. That is, the effect of lint cleaning on any fiber property measured can be expected to have a different effect at one drying level than at another level. This is taken care of in this experiment by representing the effect of drying as a line determined by lint moisture levels.

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Effects of Cleaning and Drying on Cotton Quality

The use of an elaborate seed cotton cleaning setup compared with a moderate setup caused neither improvement in grade nor deterioration of fiber properties and spinning performance (table 2). All means in table 2 have been adjusted for the effects of the covariate—lint slide moisture. These values result from using the formulation

$$y=a+bx,$$

where x is the moisture level, to estimate the values to be expected at a moisture level of 4.2 percent.

Grade and Staple Length

The use of two lint cleaners caused an improvement in grade index. Each cleaner accounted for about one-half the improvement. On the other hand, grade was not significantly affected when lint moisture was reduced from 5 to 3 percent. Stated another way, maximum grades were obtained when two lint cleaners were used, regardless of the amount of seed cotton cleaning and drying used.

Classers' staple length was reduced about one-third of a thirty-second of an inch for each 1-percent reduction in lint moisture resulting from drying.

Fiber Length (Array)

Lint cleaners had an adverse effect on all fiber length measurements except upper quartile length in both ginned lint and card sliver. Two lint cleaners had about the same adverse effects on mean length, coefficient of variation, and fibers shorter than one-half inch at the ginned lint stage as did a reduction of 1 percent in lint moisture. Drying had a greater adverse effect on card sliver than did the lint cleaners. Generally, the second lint cleaner had a much greater adverse effect on card sliver than did the first cleaner (table 3). Drying also had a greater adverse effect on card sliver than on ginned lint. Specifically, a reduction of 1 percent in lint moisture caused the coefficient of variation to increase 1 percent in ginned lint and 1.4 in card sliver. Each decrease of 1 percent in lint moisture increased short fibers in ginned lint by 0.74 percent and in card sliver by 1.26 percent. Thus from an undried lint moisture level of approximately 5 percent to a level of 3 percent, short fibers in card sliver increased 2.5 percent and the coefficient of variation in card sliver increased by 2.8 percent. This represents an increase of 16.8 percent in short fibers in ginned lint and 24.4 percent in card sliver (appendix table 8). Length measures determined by use of the Fibrograph showed similar differences, although they were not quite so sensitive.

Strength and Fineness

Neither drying nor lint cleaning significantly affected fiber strength or fineness of ginned lint. However, a reduction of 1 percent in lint moisture decreased strength of fiber in card sliver by 1.5 percent, or by 1.4 thousand pounds per square inch.

Foreign Matter, Price, and Bale Value

Visible foreign matter and total foreign matter in ginned lint were both reduced to a highly significant extent by the use of lint cleaners, elaborate seed cotton cleaning, and drying. But after mill cleaning and carding, foreign matter content of the card sliver for all treatments was equal. This relative change in content of foreign matter is reflected in differences in total waste removed in opening, picking, and carding.

In determining bale values for growers resulting from these practices, grade improvements and weight changes were considered. These improvements and changes were based on Shirley analyzer waste and moisture differences and on estimated fibrous material lost in lint cleaning.

Actual bale weights are likely to be about 5 pounds less for one lint cleaner and 8 pounds less for two lint cleaners because lint and other fibrous materials were removed by lint cleaning along with the foreign matter. A bale weight of 500 pounds was assigned to the treatment that had the highest moisture and foreign matter in the ginned lint, and the value of this bale was used as a basis of comparison (table 4).

Based on the grade and staple length of each lot and average market quotations at Fresno, Calif., for November 1959, the various combinations of lint cleaning and drying resulted in the prices per pound given in table 4. The price per pound was increased by lint cleaning and reduced by drying. Considering these relative prices, the bale-value losses due to drying were increased, and the gains due to lint cleaning were reduced when allowance is made for weight losses that were caused by drying and lint cleaning.

Based on 1959 prices, the grower lost from $3.21 to $6.29 per bale by reducing the lint moisture from 4.9 to 3.4 percent. The loss was least for one stage of lint cleaning. At the undried level of 4.9 percent, the first lint cleaner increased bale value by $0.83 and the second cleaner by an additional $1.29.

At the low moisture level, the gain in bale value due to lint cleaning was not sufficient to offset the loss in bale value due to drying. The highest bale value resulted from the use of two lint cleaners on cotton that had the highest moisture level. In November 1961, low grades of ginned lint were discounted much less than in 1959, and this resulted in much less value gained from the use of lint cleaners (table 4).

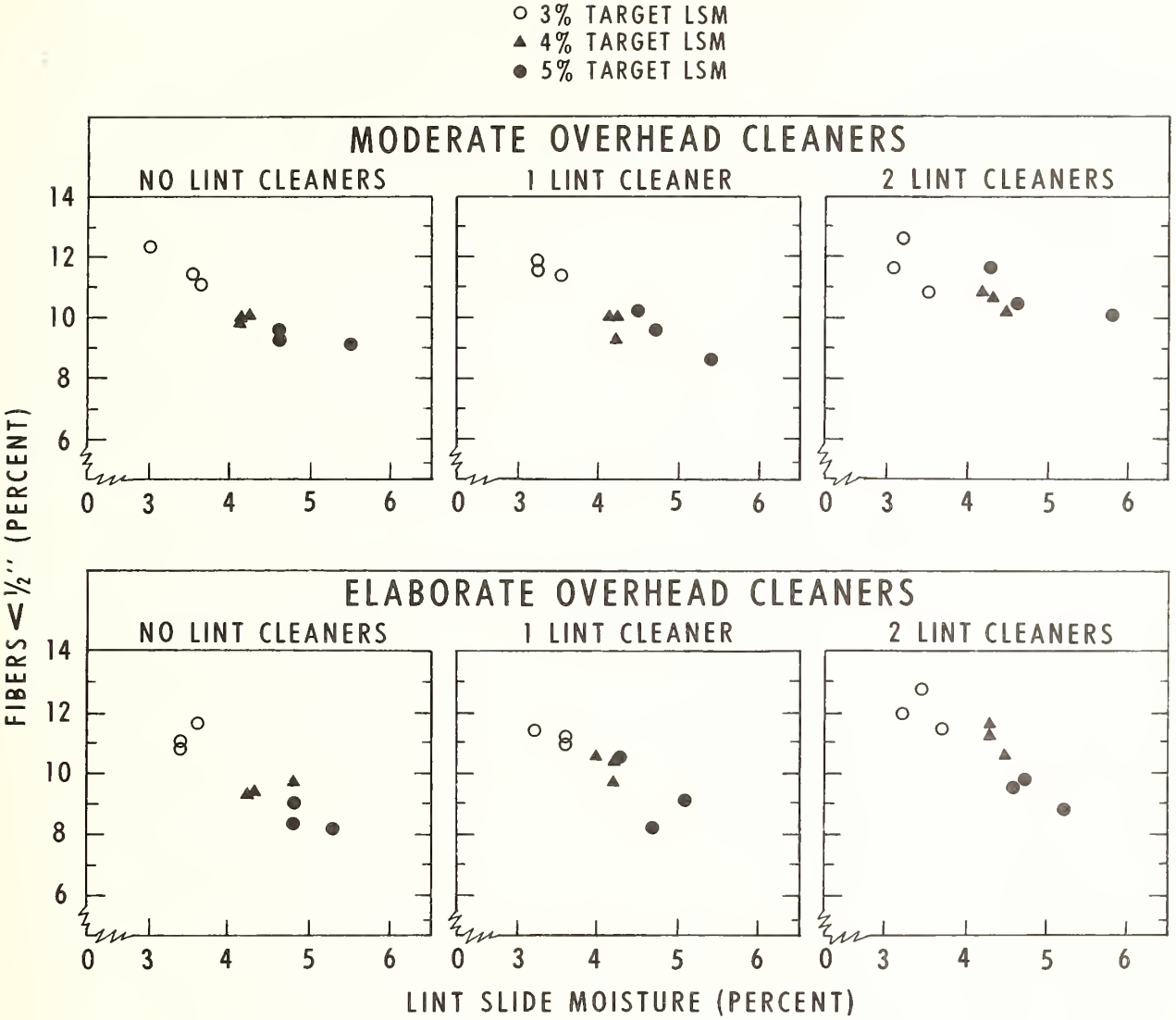

FIGURE 2.—Variations in target and actual lint moistures to fibers shorter than one-half inch.

Reducing the moisture content of ginned lint from an undried level of 4.9 percent to 3.4 percent by use of artificial heat was not profitable to the grower. Consequently, the effect of lint cleaning on bale values of cotton that had the highest moisture level—4.9 percent—is important.

Under these conditions, the highest bale value to the grower again resulted from ginning undried lint at a moisture level of about 5 percent, and there was little or no gain from the use of any lint cleaners (table 4). At the lower moisture levels, lint cleaning helped to recover part of the loss due to drying, but it was more profitable to keep moisture in the cotton than it was to take the foreign matter out.

Manufacturing Waste and Clean Cotton Cost

Total manufacturing waste adjusted to constant moisture was 6.73 percent with no lint cleaning, 6.10 percent with one cleaner, and 5.38 percent with two lint cleaners. For each 1 percent moisture removed, manufacturing waste was reduced by only 0.169 percent. Unadjusted total waste percentages by treatments are given in table 4.

The addition of 4.4 percent for bagging and ties to the waste percentages shown in table 4 and subtracting the sum from 100 makes it possible to estimate the yield of card sliver per 100 pounds of bale weight. Dividing the price of raw cotton by these yield percentages gives the "clean" cotton cost, or the cost of raw cotton per pound of card sliver produced.

TABLE 2.—*Means for main effects and significance of ginning treatment on cotton quality and spinning performance—season of 1959–60*

[For cotton grown in the Kern Delta, Calif.]

Item	Treatment means—adjusted for the effects of lint slide moisture					Statistical significance [1]				Regression on lint slide moisture [2]
	Overhead seed cotton cleaning		Number of lint cleaners			Overhead cleaning	Lint cleaner	Lint cleaner × overhead cleaning	Moisture	
	Moderate	Elaborate	None	1	2					
Fiber properties:						*Percent*	*Percent*	*Percent*	*Percent*	
Cotton grade—index	96.1	95.8	93.1	96.3	99.0	NS	**	NS	NS	----------
Staple length—32ds inch	33.6	33.6	33.5	33.7	33.6	NS	NS	NS	*	0.279
Suter-Webb array:										
Ginned lint—										
Upper quartile length—inches	1.215	1.215	1.216	1.215	1.213	NS	NS	NS	**	.0059
Mean length—do	1.010	1.010	1.015	1.012	1.001	NS	**	NS	**	.0146
Coefficient of variation—percent	29.49	29.41	28.87	29.32	30.16	NS	**	NS	**	−1.051
Fibers<½ inch [3]—do	8.81	8.72	8.38	8.67	9.25	NS	**	NS	**	−.739
Card sliver—										
Upper quartile length—inches	1.202	1.200	1.204	1.202	1.198	NS	NS	NS	**	.0108
Mean length—do	.981	.981	.988	.985	.971	NS	**	NS	**	.0214
Coefficient of variation—percent	31.33	31.08	30.71	30.95	31.96	NS	**	NS	**	−1.400
Fibers<½ inch—do	10.39	10.20	9.93	10.04	10.92	NS	**	NS	**	−1.260
Fibrograph:										
Ginned lint—										
Upper half mean—inches	1.072	1.070	1.073	1.072	1.068	NS	NS	NS	**	.0101
Mean length—do	.895	.896	.902	.896	.887	NS	**	NS	**	.0134
Uniformity ratio—percent	83.4	83.5	84.0	83.4	82.8	NS	**	NS	*	.405
Card sliver—										
Upper half mean—inches	1.069	1.069	1.073	1.070	1.063	NS	**	NS	**	.0079
Mean length—do	.880	.883	.887	.887	.871	NS	**	NS	**	.0159
Uniformity ratio—percent	82.3	82.4	82.5	82.8	81.8	NS	**	NS	**	.762
Micronaire fineness:										
Ginned lint—reading	4.52	4.52	4.50	4.54	4.51	NS	NS	NS	NS	----------
Card sliver—do	4.55	4.55	4.53	4.57	4.55	NS	NS	NS	NS	----------
Pressley strength:										
Ginned lint—										
"0" gage—1,000 lbs	94.2	94.1	94.2	94.3	93.9	NS	NS	NS	NS	----------
⅛" gage—ratio	3.67	3.67	3.67	3.70	3.68	NS	NS	NS	NS	----------
Card sliver—										
"0" gage—1,000 lbs	94.7	93.9	94.2	94.2	94.5	NS	NS	NS	*	1.404
⅛" gage—ratio	3.81	3.76	3.78	3.80	3.78	NS	NS	NS	*	.053
Shirley analyzer waste:										
Ginned lint—										
Visible foreign matter—percent	2.07	1.87	2.70	1.98	1.24	**	**	NS	**	.221
Total foreign matter—do	2.74	2.55	3.39	2.64	1.91	**	**	*	**	.252
Card sliver—										
Visible foreign matter—do	.28	.28	.27	.30	.27	NS	NS	NS	NS	----------
Total foreign matter—do	.97	.98	.97	.95	1.02	NS	NS	NS	NS	----------

In-process preparation:										
Waste:										
Opening and picking—										
Machine—percent	0.66	0.59	0.95	0.60	0.33	**	**	**	**	0.050
Total—do	.77	.70	1.07	.70	.44	**	**	*	**	.058
Carding—										
Motes and fly—do	1.29	1.25	1.56	1.26	.99	*	**	NS	*	.034
Total—do	5.32	5.34	5.67	5.40	4.93	NS	**	NS	**	.123
Total processing—do	6.10	6.04	6.73	6.10	5.38	NS	**	NS	**	.169
Neps in card web—per 100 inches	6.12	6.23	5.28	6.20	7.04	NS	**	NS	NS	
Spinning and breaks:										
First hour—EDMSH [4]	42.7	45.3	43.9	46.6	41.4	NS	NS	NS	*	−4.10
All hours—do	25.0	25.0	24.8	25.4	24.7	NS	NS	NS	NS	
Yarn properties:										
Break factor—pounds × number	2346	2366	2369	2368	2332	NS	*	**	**	70.5
Appearance grade—index	96.3	95.1	98.2	96.8	92.2	NS	**	NS	**	1.95

[1] Single asterisk * and double asterisks ** denote statistieal significance level reached of 5 percent and 1 percent respectively. NS means 5-percent level is exceeded.

[2] Values in this column indicate the extent and direction of changes in properties produced by a reduction of 1 percent in lint slide moisture. For example, 0.279 opposite staple length means that this item was reduced by 0.279 of one 32d of an inch, or about 0.01 of an inch when lint slide moisture was reduced 1 percent. The value −1.051 opposite the coefficient of variation for ginned lint means that this item increased 1.051 percent when the lint slide moisture was reduced 1 percent.

[3] Less than symbol.

[4] Ends down per thousand spindle hours.

TABLE 3.—*Lint cleaner effectiveness for stated cotton quality and spinning performance measurements—season 1959–60*

[For cotton grown in the Kern Delta, Calif. Based on a statistical comparison of treatment means. An X in one or more columns opposite a stated item identifies the comparison. The comparison is significant at the 95-percent confidence level]

Item	Differences were not shown between—			Differences were significantly higher for—					
	0 and 1 lint cleaner	0 and 2 lint cleaners	1 lint cleaner and 2 lint cleaners	No lint cleaner than for—		1 lint cleaner than for—		2 lint cleaners than for—	
				1 lint cleaner	2 lint cleaners	2 lint cleaners	No lint cleaner	No lint cleaner	1 lint cleaner
Fiber properties:									
Cotton grade							X	X	X
Staple length	X	X	X						
Suter-Webb array:									
Ginned lint—									
Upper quartile length	X	X	X						
Mean length	X				X	X			
Coefficient of variation	X							X	X
Fibers <½ inch	X							X	X
Card sliver—									
Upper quartile length	X	X	X						
Mean length	X				X	X			
Coefficient of variation	X							X	X
Fibers <½ inch	X							X	X
Fibrograph:									
Ginned lint—									
Upper half mean	X	X	X						
Mean length	X		X		X				
Uniformity ratio	X				X	X			
Card sliver—									
Upper half mean	X				X	X			
Mean length	X				X	X			
Uniformity ratio	X				X	X			
Micronaire fineness:									
Ginned lint	X	X	X						
Card sliver	X	X	X						
Pressley strength:									
Ginned lint—									
"0" gage	X	X	X						
⅛" gage	X	X	X						
Card sliver—									
"0" gage	X	X	X						
⅛" gage	X	X	X						
Shirley analyzer waste:									
Ginned lint—									
Visible foreign matter				X	X	X			
Total foreign matter				X	X	X			
Card sliver—									
Visible foreign matter	X	X	X						
Total foreign matter	X	X	X						
In-process properties:									
Waste:									
Opening and picking—									
Machine				X	X	X			
Total				X	X	X			
Carding—									
Motes and fly				X	X	X			
Total				X	X	X			
Total processing				X	X	X			
Neps in card web							X	X	X
Spinning end breaks:									
First hour				X	X	X			
All hours				X	X	X			
Yarn properties:									
Break factor	X				X	X			
Appearance grade	X				X	X			

TABLE 4.—*The effects of lint moisture and lint cleaning on stated features of ginned lint—season 1959–60*

[For cotton grown in the Kern Delta, Calif.]

BALE WEIGHT—POUNDS

Number of lint cleaners	Lint moisture level—percent		
	4.9	4.3	3.4
None	500.0	495.5	491.1
1	490.3	486.5	482.5
2	484.5	481.1	475.9
Average	491.6	487.7	483.2

1959 PRICE PER POUND—CENTS

None	30.41	29.96	29.68
1	31.18	31.26	31.02
2	31.82	31.75	31.52
Average	31.14	30.99	30.74

1959 VALUE PER BALE—DOLLARS

None	152.05	148.48	145.76
1	152.88	152.08	149.67
2	154.17	152.75	150.00
Average	153.08	151.14	148.54

1961 PRICE PER POUND—CENTS

None	33.42	32.88	32.79
1	33.98	34.16	33.76
2	34.52	34.47	34.26
Average	33.97	33.84	33.60

1961 VALUE PER BALE—DOLLARS

None	167.10	162.95	161.03
1	166.60	166.19	162.89
2	167.25	165.84	163.04
Average	167.00	165.04	162.36

TOTAL MANUFACTURING WASTE—PERCENT

None	6.90	6.35	6.50
1	5.90	6.05	5.90
2	5.45	5.20	5.15
Average	6.08	5.87	5.85

TABLE 4.—*The effects of lint moisture and lint cleaning on stated features of ginned lint—season 1959–60*—Continued

[For cotton grown in the Kern Delta, Calif.]—Continued

1959 CLEAN COTTON COSTS PER POUND—CENTS

None	34.34	33.61	33.29
1	34.76	34.91	34.60
2	35.30	35.62	34.85
Average	34.80	34.71	34.25

1961 CLEAN COTTON COSTS PER POUND—CENTS

None	37.72	36.88	36.78
1	37.90	38.15	37.64
2	38.29	38.12	37.88
Average	37.97	37.72	37.43

The lowest cost of "clean" cotton to the mill generally resulted from drying at any stage of lint cleaning. At the highest moisture level—4.9 percent—the net cost for "clean" cotton was 0.57 of a cent per pound higher ($2.85 per 500-pound bale) when two lint cleaners were used than when no cleaner was used (table 4). Although the ordinary manufacturing processes remove foreign matter at the mill, the excessive premiums paid by mills for cleaner cotton encourage the use of lint cleaners, which have about the same adverse effect on fiber length and yarn quality as does drying.

Spinning Performance and Yarn Quality

Ends down per thousand spindle hours was not affected by either drying or lint cleaning. The level of performance was about 25 EDMSH for the 8-hour test (table 2). However, during the first hour of the spinning test, a reduction of 1 percent in lint moisture caused four more spinning end breaks, or an increase of 9 percent. Hank roving used in this test was 1.25, and it is highly probable that much greater differences would have occurred had a hank roving of 1.00 or 1.10 been utilized.

Although lint cleaners improved the grade of cotton, their use adversely affected neps in the card web (fig. 3). Drying had no significant affect on neps in this test. However, the level of neps was relatively low—under 10 for all lots.

Yarn strength (break factor) was adversely affected by lint cleaners. The second cleaner was responsible for this decrease. Drying also adversely affected yarn strength because a reduction of 1 percent in lint slide moisture resulted in 71 less break factor units, or a decrease of 3 percent.

Yarn appearance grade index was adversely affected by lint cleaners and drying. Two lint cleaners reduced the grade index more than did drying—about one-half grade more. Each reduction of 1 percent in lint slide moisture caused a reduction of 2 grade index numbers, or a change of 2 percent.

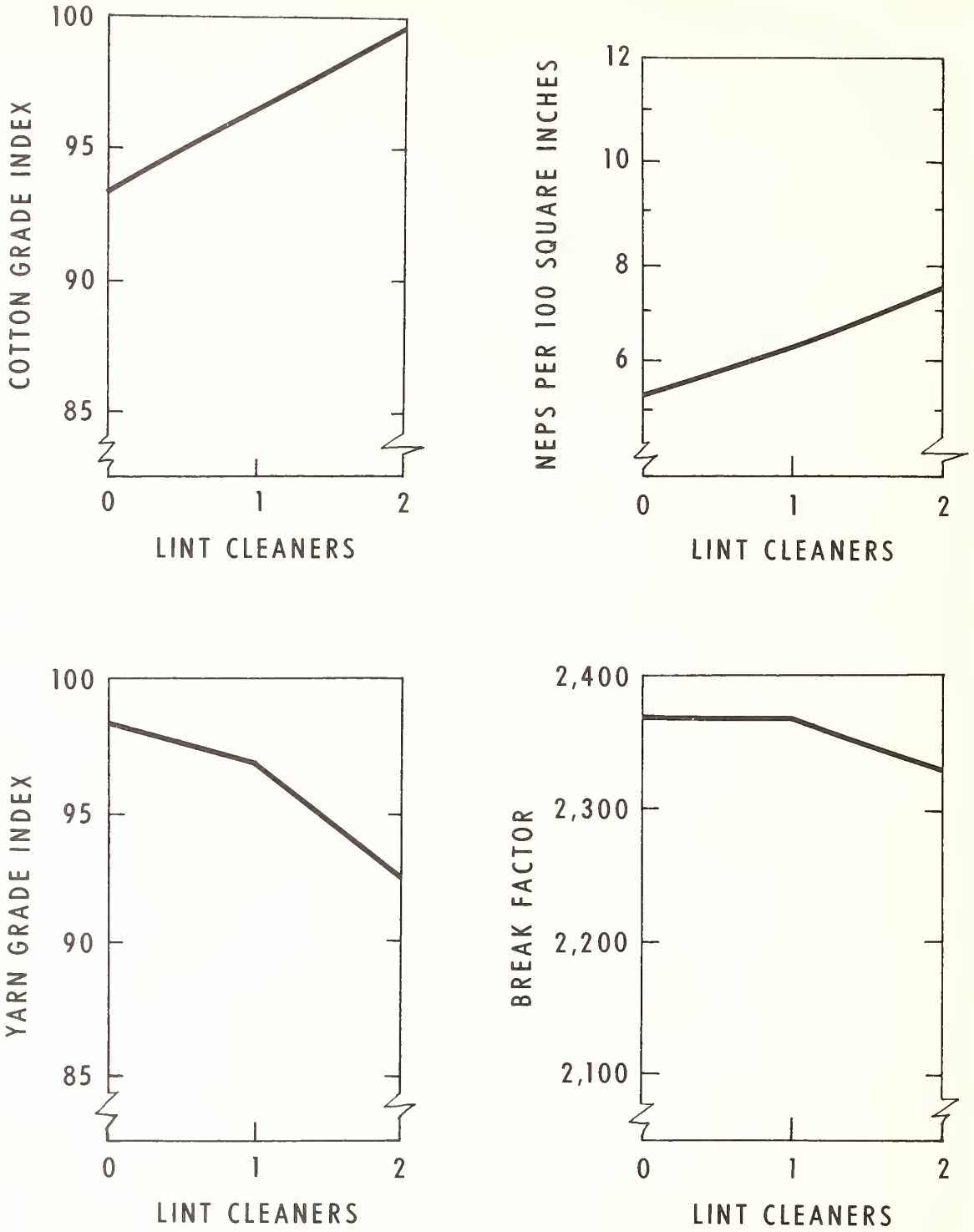

FIGURE 3.—Effect of lint cleaners on cotton grade, neps, yarn grade, and yarn strength—season 1959–60.

APPENDIX

TABLE 5.—*Treatment means for lint cleaners and overhead seed cotton cleaners—season 1959–60*

[For cotton grown in the Kern Delta, Calif.]

Items	Within overhead cleaners						Within lint cleaners					
	Moderate setup			Elaborate setup			No lint cleaner		1 lint cleaner		2 lint cleaners	
	No lint cleaner	1 lint cleaner	2 lint cleaners	No lint cleaner	1 lint cleaner	2 lint cleaners	Moderate setup	Elaborate setup	Moderate setup	Elaborate setup	Moderate setup	Elaborate setup
Fiber properties:												
Cotton grade—index	93.1	96.3	99.0	92.6	96.0	99.0	93.1	92.9	96.3	96.0	99.0	99.0
Staple length—32d inch	33.5	33.8	33.4	33.5	33.6	33.7	33.5	33.5	33.8	33.6	33.4	33.7
Suter-Webb array:												
Ginned lint—												
Upper quartile length—inches	1.216	1.216	1.211	1.216	1.215	1.214	1.216	1.216	1.216	1.215	1.211	1.214
Mean length—do	1.016	1.014	1.000	1.015	1.010	1.003	1.016	1.015	1.014	1.010	1.000	1.003
Coefficient of variation—percent	28.95	29.29	30.23	28.79	29.35	30.09	28.95	28.79	29.29	29.35	30.23	30.09
Fibers <½ inch—do	8.44	8.64	9.36	8.32	8.71	9.14	8.44	8.32	8.64	8.71	9.36	9.14
Card sliver—												
Upper quartile length—inches	1.207	1.202	1.198	1.202	1.201	1.198	1.207	1.202	1.202	1.201	1.198	1.198
Mean length—do	.989	.982	.971	.986	.987	.970	.989	.986	.982	.987	.971	.970
Coefficient of variation—percent	30.84	31.23	31.94	30.58	30.68	31.97	30.84	30.58	31.23	30.68	31.94	31.97
Fibers <½ inch—do	10.09	10.17	10.91	9.76	9.91	10.92	10.09	9.76	10.17	9.91	10.91	10.92
Fibrograph:												
Ginned lint—												
Upper half mean—inches	1.074	1.074	1.067	1.071	1.070	1.070	1.074	1.071	1.074	1.070	1.067	1.070
Mean length—do	.904	.897	.883	.900	.895	.891	.904	.900	.897	.895	.883	.891
Uniformity ratio—percent	84.1	83.3	82.7	84.0	83.6	83.0	84.1	84.0	83.3	83.6	82.7	83.0
Card sliver—												
Upper half mean—inches	1.074	1.070	1.063	1.073	1.071	1.063	1.074	1.073	1.070	1.071	1.063	1.063
Mean length—do	.884	.885	.872	.890	.888	.870	.884	.890	.885	.888	.872	.870
Uniformity ratio—percent	82.2	82.8	81.9	82.7	82.8	81.7	82.2	82.7	82.8	82.8	81.9	81.7
Micronaire fineness:												
Ginned lint—reading	4.51	4.54	4.52	4.50	4.54	4.51	4.51	4.50	4.54	4.54	4.52	4.51
Card sliver—do	4.54	4.57	4.54	4.52	4.56	4.56	4.54	4.52	4.57	4.56	4.54	4.56
Pressley strength:												
Ginned lint—												
"0" gage—1,000 lbs	94.4	94.1	94.1	94.0	94.5	93.6	94.4	94.0	94.1	94.5	94.1	93.6
⅛" gage—ratio	3.69	3.66	3.67	3.64	3.73	3.69	3.69	3.64	3.66	3.73	3.67	3.69
Card sliver—												
"0" gage—1,000 lbs	95.1	94.1	94.8	93.3	94.2	94.2	95.1	93.3	94.1	94.2	94.8	94.2
⅛" gage—ratio	3.84	3.82	3.78	3.72	3.78	3.78	3.84	3.72	3.82	3.78	3.78	3.78
Shirley analyzer waste:												
Ginned lint—												
Visible foreign matter—percent	2.85	2.10	1.26	2.55	1.87	1.21	2.85	2.55	2.10	1.87	1.26	1.21
Total foreign matter—do	3.59	2.71	1.92	3.19	2.57	1.90	3.59	3.19	2.71	2.57	1.92	1.90
Card sliver—												
Visible foreign matter—do	.27	.28	.28	.27	.31	.26	.27	.27	.28	.31	.28	.26
Total foreign matter—do	.95	.93	1.03	.98	.96	1.00	.95	.98	.93	.96	1.03	1.00

TABLE 5.—*Treatment means for lint cleaners and overhead seed cotton cleaners—season 1959–60*—Continued

[For cotton grown in the Kern Delta, Calif.]

Items	Within overhead cleaners						Within lint cleaners					
	Moderate setup			Elaborate setup			No lint cleaner		1 lint cleaner		2 lint cleaners	
	No lint cleaner	1 lint cleaner	2 lint cleaners	No lint cleaner	1 lint cleaner	2 lint cleaners	Moderate setup	Elaborate setup	Moderate setup	Elaborate setup	Moderate setup	Elaborate setup
In-process properties:												
Waste:												
Opening and picking—												
Machine——percent	1.00	0.66	0.33	0.90	0.54	0.33	1.00	0.90	0.66	0.54	0.33	0.33
Total——do	1.12	.77	.43	1.01	.64	.45	1.12	1.01	.77	.64	.43	.45
Carding—												
Motes and fly——do	1.59	1.29	.99	1.53	1.23	.99	1.59	1.53	1.29	1.23	.99	.99
Total——do	5.70	5.36	4.90	5.63	5.43	4.95	5.70	5.63	5.36	5.43	4.90	4.95
Total processing——do	6.82	6.13	5.36	6.64	6.07	5.40	6.82	6.64	6.13	6.07	5.36	5.40
Neps in card web——per 100 inches	5.36	6.14	6.87	5.21	6.26	7.21	5.36	5.21	6.14	6.26	6.87	7.21
Spinning end breaks:												
First hour——EDMSH[1]	43.8	43.6	40.7	44.0	49.7	42.0	43.8	44.0	43.6	49.7	40.7	42.0
All hours——do	25.1	24.1	25.7	24.5	26.7	23.7	25.1	24.5	24.1	26.7	25.7	23.7
Yarn properties:												
Break factor——pounds×number	2375	2327	2335	2362	2408	2329	2375	2362	2327	2408	2335	2329
Appearance grade——index	97.8	99.0	92.2	98.7	94.6	92.1	97.8	98.7	99.0	94.6	92.2	92.1

[1] Ends down per thousand spindle hours.

TABLE 6.—*Lint cleaner effectiveness within 2 seed cotton overhead cleaner setups for stated cotton quality and spinning performance measurements—season 1959–60*

[For cotton grown in the Kern Delta, Calif. Based on comparison of treatment means. An X in one or more columns opposite a stated item identifies the comparison]

Items	Moderate overhead setup								
	Differences were not shown between—			Differences were significantly higher for—					
	No lint cleaner and 1 lint cleaner	No lint cleaner and 2 lint cleaners	1 lint cleaner and 2 lint cleaners	No lint cleaner than for—		1 lint cleaner than for—		2 lint cleaners than for—	
				1 lint cleaner	2 lint cleaners	2 lint cleaners	No lint cleaner	No lint cleaner	1 lint cleaner
Fiber Properties:									
Cotton grade							X	X	X
Staple length	X	X	X						
Suter-Webb array:									
Ginned lint—									
Upper quartile length	X	X	X						
Mean length	X				X	X			
Coefficient of variation	X							X	X
Fibers <½ inch	X							X	X
Card sliver—									
Upper quartile length	X		X		X				
Mean length	X		X		X				
Coefficient of variation	X							X	X
Fibers <½ inch	X							X	X
Fibrograph:									
Ginned lint—									
Upper half mean	X	X	X						
Mean length	X				X	X			
Uniformity ratio	X		X		X				
Card sliver—									
Upper half mean	X		X		X				
Mean length	X				X	X			
Uniformity ratio	X	X				X			
Micronaire fineness:									
Ginned lint	X	X	X						
Card sliver	X	X	X						
Pressley strength:									
Ginned lint—									
"0" gage	X	X	X						
⅛" gage	X	X	X						
Card sliver—									
"0" gage	X	X	X						
⅛" gage	X	X	X						
Shirley analyzer waste:									
Ginned lint—									
Visible foreign matter				X	X	X			
Total foreign matter				X	X	X			
Card sliver—									
Visible foreign matter	X	X	X						
Total foreign matter	X	X	X						
In-process properties:									
Waste:									
Opening and picking—									
Machine				X	X	X			
Total				X	X	X			
Carding—									
Motes and fly				X	X	X			
Total				X	X	X			
Total processing				X	X	X			
Neps in card web							X	X	X
Spinning end breaks:									
First hour	X	X	X						
All hours	X	X	X						
Yarn properties:									
Break factor		X	X	X					
Appearance grade	X				X	X			

TABLE 6.—*Lint cleaner effectiveness within 2 seed cotton overhead cleaner setups for stated cotton quality and spinning performance measurements—season 1959-60*—Continued

[For cotton grown in the Kern Delta, Calif. Based on comparison of treatment means. An X in one or more columns opposite a stated item identifies the comparison]—Continued

Items	Elaborate overhead setup								
	Differences were not shown between—			Differences were significantly higher for—					
				No lint cleaner than for—		1 lint cleaner than for—		2 lint cleaners than for—	
	No lint cleaner and 1 lint cleaner	No lint cleaner and 2 lint cleaners	1 lint cleaner and 2 lint cleaners	1 lint cleaner	2 lint cleaners	2 lint cleaners	No lint cleaner	No lint cleaner	1 lint cleaner
Fiber Properties:									
Cotton grade							X	X	X
Staple length	X	X	X						
Suter-Webb array:									
Ginned lint—									
Upper quartile length	X	X	X						
Mean length	X		X		X				
Coefficient of variation							X	X	X
Fibers $<\frac{1}{2}$ inch	X							X	X
Card sliver—									
Upper quartile length	X	X	X						
Mean length	X				X	X			
Coefficient of variation	X							X	X
Fibers $<\frac{1}{2}$ inch	X							X	X
Fibrograph:									
Ginned lint—									
Upper half mean	X	X	X						
Mean length	X	X	X						
Uniformity ratio	X		X		X				
Card sliver—									
Upper half mean	X		X		X				
Mean length	X				X	X			
Uniformity ratio	X				X	X			
Micronaire fineness:									
Ginned lint	X	X	X					X	
Card sliver	X		X						
Pressley strength:									
Ginned lint—									
"0" gage	X	X	X						
$\frac{1}{8}$" gage		X	X				X		
Card sliver—									
"0" gage	X	X	X						
$\frac{1}{8}$" gage	X	X	X						
Shirley analyzer waste:									
Ginned lint—									
Visible foreign matter				X	X	X			
Total foreign matter				X	X	X			
Card sliver—									
Visible foreign matter	X	X				X			
Total foreign matter	X	X	X						
In-process properties:									
Waste:									
Opening and picking—									
Machine				X	X	X			
Total				X	X	X			
Carding—									
Motes and fly				X	X	X			
Total				X	X	X			
Total processing				X	X	X			
Neps in card web							X	X	X
Spinning end breaks:									
First hour	X	X	X						
All hours	X	X	X						
Yarn properties:									
Break factor		X				X	X		
Appearance grade	X		X		X				

TABLE 7.—*Seed cotton overhead cleaning effectiveness within lint cleaners for stated cotton quality and spinning performance measurements—season 1959–60*

[For cotton grown in the Kern Delta, Calif. Based on a comparison of treatment means. An X in one or more columns opposite a stated item identifies the comparison]

Items	No lint cleaner		1 lint cleaner		2 lint cleaners
	Differences were not shown between a moderate overhead setup and an elaborate setup	Differences were significantly higher for a moderate overhead setup than for an elaborate setup	Differences were not shown between either kind of overhead setup	Differences were significantly higher for a moderate overhead setup than for an elaborate setup	Differences were not shown between either kind of overhead setup
Fiber properties:					
Cotton grade	X		X		X
Staple length	X		X		X
Suter-Webb array:					
Ginned lint—					
Upper quartile length	X		X		X
Mean length	X		X		X
Coefficient of variation	X		X		X
Fibers<½ inch	X		X		X
Card sliver—					
Upper quartile length	X		X		X
Mean length	X		X		X
Coefficient of variation	X		X		X
Fibers<½ inch	X		X		X
Fibrograph:					
Ginned lint—					
Upper half mean	X		X		X
Mean length	X		X		X
Uniformity ratio	X		X		X
Card sliver—					
Upper half mean	X		X		X
Mean length	X		X		X
Uniformity ratio	X		X		X
Micronaire fineness:					
Ginned lint	X		X		X
Card sliver	X		X		X
Pressley strength:					
Ginned lint—					
"0" gage	X		X		X
⅛" gage	X		X		X
Card sliver—					
"0" gage	X		X		X
⅛" gage	X		X		X
Shirley analyzer waste:					
Ginned lint—					
Visible foreign matter		X		X	X
Total foreign matter		X	X		X
Card sliver—					
Visible foreign matter	X		X		X
Total foreign matter	X		X		X
In-process properties:					
Waste:					
Opening and picking—					
Machine		X		X	X
Total		X		X	X
Carding—					
Motes and fly		X	X		X
Total	X		X		X
Total processing	X		X		X
Neps in card web	X		X		X
Spinning end breaks:					
First hour	X		X		X
All hours	X		X		X
Yarn properties:					
Break factor	X		X		X
Appearance grade	X			X	X

TABLE 8.—*Overall means and their percentage change resulting from a 1-percent increase in lint slide moisture—season 1959–60*

[For cotton grown in the Kern Delta, Calif.]

Item	Overall mean	
	Value	Change
Fiber properties:		*Percent*
Cotton grade_____index__	96.1	_____
Staple length_____32ds inch__	33.6	.83
Suter-Webb array:		
Ginned lint—		
Upper quartile length_inches__	1.215	.49
Mean length_____do____	1.009	1.45
Coefficient of variation percent__	29.45	−3.57
Fibers <½ inch_____do____	8.77	−8.43
Card sliver—		
Upper quartile length_inches__	1.201	.90
Mean length_____do____	.981	2.18
Coefficient of variation percent__	31.21	−4.49
Fibers <½ inch_____do____	10.30	−12.23
Fibrograph:		
Ginned lint—		
Upper half mean_____inches__	1.071	.943
Mean length_____do____	.895	1.50
Uniformity ratio_____percent__	83.4	.49
Card sliver—		
Upper half mean_____inches__	1.069	.74
Mean length_____do____	.882	1.80
Uniformity ratio_____percent__	82.4	.92
Micronaire fineness:		
Ginned lint_____	_____	_____
Card sliver_____	_____	_____

Item	Overall mean	
	Value	Change
Pressley strength:		*Percent*
Ginned lint—		
"0" gage_____1,000 pounds__	94.1	_____
⅛" gage_____ratio__	3.67	_____
Card sliver—		
"0" gage_____1,000 pounds__	94.3	1.49
⅛" gage_____ratio__	3.79	1.40
Shirley analyzer:		
Ginned lint—		
Visible foreign matter_percent__	1.97	11.22
Total foreign matter___do____	2.65	9.51
Card sliver—		
Visible foreign matter__do____	.28	_____
Total foreign matter___do____	.98	_____
In-process properties:		
Waste:		
Opening and picking—		
Machine_____	.63	7.94
Total_____	.74	7.84
Carding—		
Motes and fly_____	1.27	2.68
Total_____	5.33	2.31
Total processing_____	6.07	2.78
Neps in card web/100 inches_____	6.13	_____
Spinning end breaks:		
First hour_____EDMSH____	44.0	−9.32
All hours_____do____	25.0	_____
Yarn properties:		
Break factor_____	2356	2.99
Appearance grade_____index___	95.7	2.04

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