INFLUENCE OF SELECTED GIN- AND MILL-CLEANING TREATMENTS ON COTTON-DUST LEVELS, SPINNING PERFORMANCE, AND YARN QUALITY

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INFLUENCE OF SELECTED GIN- AND MILL-CLEANING TREATMENTS ON COTTON-DUST LEVELS, SPINNING PERFORMANCE, AND YARN QUALITY. R. V. Baker, J. D. Bargeron III, and A. D. Brashears. U.S. Dep. Agric. Mark. Res. Rep. No. 1108, 8 pp.

Three gin-cleaning levels consisting of minimum, normal, and elaborate amounts of machinery were compared. Mill cleaning consisted of two levels of cleaning before a single stage of carding and one level of cleaning in combination with double carding. Increased gin cleaning lowered foreign-matter contents of cotton at the feeder apron but had no effect on ginning rate. The normal and elaborate treatments produced lower foreign-matter contents in ginned lint and cottonseed than did the minimum treatment. Each increase in gin-cleaning level raised the classer's grade of about one-half of the test lots but had little effect on staple length or micronaire reading. Fiber-length measurements were affected slightly by gin-cleaning treatments, but fiber strength was not affected by any of the experimental treatments. There was no significant difference in processing waste between the normal and elaborate treatments, but the minimum treatment produced about 20 percent more waste than the other two treatments. Each increase in mill-cleaning level increased processing waste. Cardroom dust levels decreased with increased gin cleaning, but the difference between minimum and normal gin cleaning was not statistically significant. The elaborate treatment reduced cardroom dust levels about 16 percent when compared with the normal treatment. Increased mill cleaning before carding had no significant effect on cardroom dust levels, but the dust level during the second stage of carding was 50 percent lower than during the first stage. Ends down during ring spinning increased significantly with each increase in gin cleaning, and the mill-cleaning treatment with double carding produced a higher number of ends down than did the treatments with single carding. Rotor residue decreased about 25 to 30 percent with each increase in gin cleaning. There was no significant difference in rotor deposits between the mill-cleaning treatments with single carding, but the treatment with double carding was very effective in reducing these deposits. Open-end and ring-spun yarns from the minimum gin-cleaning treatment were stronger and more uniform than yarns from the other two treatments. However, there was little difference among gin-cleaning treatments in yarn appearance and single-strand strength. Yarn quality was affected only slightly by mill-cleaning levels. For ring-spun yarns, the double-carding treatment produced a slightly higher yarn appearance index and fewer neps than the other mill treatments; for the open-end yarns, it produced more neps than the other mill treatments. There was little difference in bale loan value between the minimum and normal gin-cleaning treatments, but the elaborate treatment lowered bale values by excessively reducing bale weights during seed-cotton cleaning. These data should be useful to researchers, textile-mill operators, and others in the cotton industry for developing improved methods of reducing dust levels in ginned lint. Keywords: cotton-dust levels, gin-cleaning levels, lint quality, mill-cleaning levels, rotor residue deposits, spinning performance, yarn quality.

Influence of Selected Gin- and Mill-Cleaning Treatments on Cotton-Dust Levels, Spinning Performance, and Yarn Quality

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INTRODUCTION

Cotton dust is a problem of increasing importance to the cotton industry and is of immediate concern to the cotton processing segment of the industry because of the adverse economic impact that is anticipated from the recent adoption of more stringent dust-level standards by the Occupational Safety and Health Administration and because of rotor and turbine fouling problems in open-end spinning. Other segments of the cotton industry are concerned about the long-term effects of the dust problem on future market demand for cotton. Effective methods of reducing dust levels in ginned lint are urgently needed to insure the future well-being of the cotton industry.

The amount of dust generated during the processing of cotton at the textile mill is affected by many factors (Cocke et al. 1978). Cocke et al. (1976) reported significant reductions in cardroom dust levels as a result of varying seed-cotton drying and lint cleaning at the gin from a minimum level up to near recommended levels and increasing the amount of mill cleaning before carding. Other studies have shown that increased usage of gin-type lint cleaners offers possibilities for lowering cardroom dust levels and for reducing the buildup of residue in open-end spinning rotors (Sasser et al. 1976, Towery and Baker 1979). However, several studies have shown that increased gin cleaning can adversely affect spinning performance and yarn quality (Mangialardi 1976, Looney et al. 1963, Cocke et al. 1977, Baker et al. 1977). The purpose of this study was to obtain more detailed information on the effects of increased levels of gin and mill cleaning on cardroom dust levels, residue buildup in open-end spinning rotors, open-end and ring spinning performance, and yarn quality.

MATERIALS AND METHODS

Test Cotton

The cotton used in this experiment, 'Paymaster 909', was grown by a private producer on an irrigated farm near Lubbock, Tex., during 1975-76. The cotton was harvested in late November by a conventional two-row brush stripper and ginned about 1 week later at USDA's South Plains Cotton Ginning Research Laboratory, Lubbock, Tex.

Gin Processing

Ginning treatments consisted of three levels of cleaning as outlined in table 1. Treatment G1 was a minimum gin-cleaning arrangement consisting of less machinery than that normally used for stripper cotton. Treatment G2 was a typical gin-cleaning arrangement consisting of the types and amounts of machinery normally recommended for stripper cotton. Treatment G3 was an elaborate gin-cleaning arrangement not normally used for stripper cotton, consisting of the recommended amounts of cleaning machinery plus two additional seed-cotton-cleaning machines and an additional stage of lint cleaning.

Seed-cotton drying was not required during ginning because of the low initial moisture content of

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Table 1.—Description of gin- and mill-cleaning treatments

Treatment and code	Description
Gin cleaning:	
G1	Minimum—16 cleaning cylinders, bur machine, extractor feeder, and lint cleaner.
G2	Normal—16 cleaning cylinders, bur machine, stick machine, extractor feeder, and 2 lint cleaners.
G3	Elaborate—22 cleaning cylinders, bur machine, 2 stick machines, extractor feeder, and 3 lint cleaners.
Mill cleaning:	
M1	Vertical opener, No. 12 opener, and single carding.
M2	Vertical opener, No. 12 opener, superior cleaner, and single carding.
M3	Vertical opener, No. 12 opener, superior cleaner, and double carding.

the test cotton (about 7 percent). Therefore, unheated ambient air was used to convey the cotton through the drying system. The relative humidity of the ambient air during these experiments ranged from 18 to 40 percent.

The test cotton was processed through the seed-cotton-cleaning systems at rates of approximately one bale per hour per foot of width for the inclined cleaners and stick machines and one-half bale per hour per foot of length for the bur machine. All cotton was ginned on one high-capacity gin stand at a rate of about four bales per hour. The lint cleaners operated at a combing ratio of 18:1 with a batt weight of approximately 0.03 pound per square foot.

Mill Processing

The cotton from each gin-cleaning treatment was subjected to three levels of mill cleaning during opening and carding at USDA's Cotton Quality Research Station, Clemson, S.C., as shown in table 1.

The picker laps, 14-ounce-per-yard, were carded at 20 pounds per hour to produce a 50-grain-per-yard sliver. For double carding, six 940-grain-per-yard comber laps were fed to the card. At breaker drawing a 53-grain-per-yard sliver was formed at a front-roll speed of 265 feet per minute. A 55-grain-per-yard sliver was formed at a front-roll speed of 265 feet per minute at finisher drawing. A 1.0-hank roving was produced with a 1.30-twist multiplier at a spindle speed of 900 revolutions per minute. A 30-Ne (19.7-tex)[4] ring yarn was spun on a Saco-Lowell SF-3H Tru-Set frame with a 3.75-twist multiplier at a spindle speed of 11,500 revolutions per minute. A 12-Ne (49.2-tex) yarn was spun on a Platt type 883 Rotospin open-end spinning frame with a 5.0-twist multiplier at a rotor speed of 46,000 revolutions per minute.

Testing and Analysis

Seed-cotton and lint samples were obtained during ginning for moisture and foreign-matter analyses. Cottonseed samples were obtained after ginning for determination of foreign-matter content and seed damage. Bale loan values were calculated by using Commodity Credit Corporation loan rates and adjusted bale weights. Bale weights were computed by adjusting actual bur-cotton lot weights to a common base of 2,840 pounds, which allowed adjusted bale weights for the various treatments to fall within the normal bale-weight range of 450 to 550 pounds.

Fibrograph length, Pressley strength, and micronaire-fineness measurements were made on four subsamples of ginned lint from the bases before blending and on one sample of finisher-drawing sliver. One measurement of skin strength and one of yarn size were made on each of 40 bobbins from the ring frames, and one of each of these measurements was made on each of 10 tubes from the open-end spinning frame. Eight bobbins were tested for yarn evenness and imperfections for each type of yarn. The sensitivity of the imperfection indicator was set at 30 percent for thin places and at setting No. 4 for thick places and neps. Yarn from each bobbin was tested at 25 yards per minute for 5 minutes. Ten single-strand-strength measurements were made on each of 40 bobbins of ring-spun yarn, and 20 measurements were made from each of 10 tubes of open-end yarn. Yarn grade was determined from three yarn boards by three technicians for each type of yarn.

[4]Ne, symbol of the indirect system of arriving at the yarn number. It denotes length per unit of mass or the number of hanks (840 yards) required to weigh 1 lb; thus, the larger the Ne number, the smaller the yarn size.

Table 2.—Effects of gin-cleaning treatments on moisture and foreign-matter contents, fiber properties, ginning rates, cottonseed damage, bale weights, and bale values[1]

Measurement		Treatment[2]		
		G1	G2	G3
Foreign-matter content:				
Wagon bur cotton	pct	39.1	38.7	38.7
Feeder seed cotton	pct	7.2c	4.1b	3.3a
Press lint	pct	4.7b	3.5a	3.2a
Ginned cottonseed	pct	4.3b	1.8a	1.2a
Moisture content:				
Wagon bur cotton	pct	7.1	7.3	7.4
Feeder seed cotton	pct	6.3	6.2	6.1
Press lint	pct	5.2	5.1	5.2
Ginning rate	bales/h	3.9a	3.9a	3.8a
Cottonseed damage	pct	11.4a	13.7a	19.7b
Bale weight[3]	lb	498c	480b	461a
Grade index[4]		86a	91ab	95b
Staple length	32d inch	29.8	29.8	29.5
Micronaire reading		3.1	3.1	3.1
Bale loan value[5]		$194b	$193b	$187a

[1]Each value is the average of 9 test lots. Means in a row followed by different letters are significantly different at the 0.05 level.

[2]See table 1 for treatment descriptions.

[3]Weight of lint obtained from processing 2,840 lb of bur cotton.

[4]Middling Light Spotted = 97; Strict Low Middling Light Spotted = 89; Low Middling Light Spotted = 80.

[5]Bale values based on 1978 Commodity Credit Corporation loan rates for Lubbock, Tex.

Gin-processing data were analyzed by analysis of variance for a randomized complete-block experiment consisting of three gin-cleaning levels and three replications. Mill-processing and yarn-quality data were analyzed by analysis of variance for a randomized complete-block design involving a factorial treatment arrangement. Factors for the mill data were three levels of gin cleaning and three levels of mill cleaning, with three replications. Significant differences between levels of gin cleaning and mill cleaning were determined by Duncan's new multiple-range test.

RESULTS

Gin and Mill Processing

Moisture and foreign-matter contents

The effects of gin-cleaning levels on selected gin-performance measurements are given in table 2. There were no significant differences in initial moisture or foreign-matter content of cotton lots subjected to the three gin-cleaning treatments. Initial foreign-matter content of the test cotton (38.7 to 39.1 percent) was higher than normal for stripper-harvested cotton, but initial bur-cotton moisture content (7.1 to 7.4 percent) was about average for the Lubbock, Tex., area. Also, there were no significant differences among cleaning treatments in seed-cotton moisture content at the feeder apron or in lint-moisture content at the press.

The gin-cleaning treatments produced large and significant differences in foreign-matter content of seed cotton at the feeder apron and in lint at the press. Total foreign-matter contents at the feeder apron resulting from treatments G1, G2, and G3 averaged 7.2, 4.1, and 3.3 percent, respectively. After lint cleaning, the foreign-matter contents of the lint ranged from 4.7 percent for treatment G1 to 3.2 percent for treatment G3. The foreign-matter contents of the cottonseed followed a similar trend. A large and significant difference occurred between treatments G1 and G2, but the difference between treatments G2 and G3 was small and not statistically significant.

Table 3.—Effects of gin-cleaning treatments on length and strength of ginned-lint fibers[1]

Measurement	Treatment[2]		
	G1	G2	G3
Fibrograph:			
2.5-pct span length .... inches................	0.906	0.902	0.901
Uniformity ratio .... pct...............	44	44	43
Array length:			
Upper-quartile length .... inches................	0.995	0.990	0.980
Mean length .... do..............	0.781b	0.782b	0.768a
Coefficient of variability .... pct...............	35	35	35
Fibers less than ½ inch .... pct...............	18	18	19
Fiber strength:			
Zero-inch gage .... 1,000 lb/in^2..............	84	83	83
1/8-inch gage .... g/tex...............	23.7	23.6	23.5

[1]Each value is the average of 9 test lots. Means in a row followed by different letters are significantly different at the 0.05 level.
[2]See table 1 for treatment descriptions.

Ginning rates and cottonseed damage

Ginning rate ranged from 3.8 to 3.9 bales per hour and was not affected by the gin-cleaning treatments. Cottonseed damage increased with increasing levels of gin cleaning, although the difference between treatments G1 and G2 was small and not significant. Treatment G3 produced the highest level of cottonseed damage (19.7 percent), and this level was substantially higher than that of treatment G2 (13.7 percent).

Classer's grades and micronaire values

Classer's grade index increased with increased levels of gin cleaning. The grade index for treatment G1 averaged 86, while for treatment G3 it averaged 95. Treatment G2 produced an intermediate index value of 91. Fifty-five percent of the test lots receiving the normal amount of cleaning (G2) were classed one full grade higher than the test lots receiving the minimum amount of cleaning (G1), and an equal number of lots receiving the elaborate amount of cleaning (G3) graded higher than those lots receiving the normal amount of cleaning. In this experiment grades ranged from Low Middling Light Spotted up to Middling Light Spotted. Classer's staple length and micronaire value were not significantly affected by gin-cleaning level.

Bale values and weights

There was no significant difference in bale loan value between treatments G1 and G2, but the loan value for treatment G3 was significantly lower than those for the other treatments, by $6 to $7 per bale. Bale loan values were affected to a large degree by changes in bale weight, which decreased significantly with each increase in gin-cleaning level. The difference in bale weight between treatments G1 and G2 appeared normal, but the large difference in weight between treatments G2 and G3 was surprising. Ordinarily, the third stage of lint cleaning reduces bale weight by only 3 to 5 pounds, but in this experiment we experienced a reduction of 19 pounds. An examination of cottonseed weights helps to explain this large difference in bale weights. Clean-cottonseed weights from treatments G1, G2, and G3 averaged 860, 858, and 822 pounds per bale, respectively. The low weight for treatment G3 indicates that the elaborate seed-cotton-cleaning arrangement was wasting an excessive amount of seed cotton, and this loss appeared to affect bale weight to a larger degree than did the third stage of lint cleaning. Thus, the loss of $6 to $7 per bale in treatment G3 was likely attributable to excessive seed-cotton cleaning rather than to the third stage of lint cleaning.

Fiber properties

Ginned-lint fiber properties are shown in table 3. The three gin-cleaning treatments yielded lint of

Table 4.—Effects of gin- and mill-cleaning treatments on fiber properties of finisher-drawing sliver, processing waste, and cardroom dust levels[1]

Treatment[2]	Fibrograph		Fiber strength, 1/8-inch gage (g/tex)	Opening, picking, and carding waste (pct)	Cardroom dust levels	
	2.5-pct span length (inches)	Uniformity ratio (pct)			Personal sampler (mg/m³)	Vertical elutriator sampler (mg/m³)
Gin cleaning:						
G1	0.972a	50a	22.8a	6.98a	2.73a	1.95a
G2	0.961b	49a	22.9a	5.76a	2.53ab	1.80a
G3	0.963b	49a	22.7a	5.69b	2.15b	1.51b
Mill cleaning:						
M1	0.964ab	49a	22.8a	5.10b	2.86a	2.09a
M2	0.972a	49a	22.8a	5.75a	2.87a	2.11a
M3	0.960b	49a	22.8a	7.58c	[3]1.69b	[3]1.07b

[1]Each value is the average of 9 test lots. Means in a column for a given type of cleaning followed by different letters are significantly different at the 0.05 level.
[2]See table 1 for treatment descriptions.
[3]Cardroom dust level for second stage of carding.

essentially the same fiber properties. Mean length by the array method was the only ginned-lint fiber property significantly affected by gin cleaning. The mean length of lint from treatment G3 was about 0.013 inch shorter than lint from the other treatments, but this small difference was of minor importance. The other length and strength measurements shown in table 3 were not significantly affected by level of gin cleaning.

Finisher-drawing-sliver properties are shown in table 4. Fibograph 2.5-percent span-length measurements were affected to a slight degree by both gin- and mill-cleaning treatments. Gin-cleaning treatments G2 and G3 produced a slightly lower 2.5-percent span length than did treatment G1. Differences in 2.5-percent span length among mill-cleaning treatments were erratic and generally of little practical importance. Uniformity-ratio and fiber-strength measurements were not significantly affected by gin- or mill-cleaning treatments.

Cardroom waste and dust levels

Total opening, picking, and carding waste ranged from 4.74 to 8.29 percent in this experiment. Gin-cleaning treatments G2 and G3 produced approximately the same level of processing waste, while treatment G1 resulted in approximately 20 percent more waste (table 4). Each increase in mill-cleaning level produced a significant increase in processing waste. The amount of waste obtained with treatment M1 was about 30 percent lower than that obtained with treatment M3.

The amount of dust liberated during carding was measured with both personal sampler and vertical elutriator sampler (table 4). Since the results from both dust samplers tended to follow a similar pattern, we elected to discuss only the results of the vertical elutriator measurements. There was a tendency for cardroom dust level to decrease with increased gin cleaning, although the difference between minimum gin cleaning (G1) and normal cleaning (G2) was too small to be statistically significant. The elaborate gin-cleaning treatment (G3) reduced cardroom dust level about 16 percent when compared with the normal treatment. Dust levels as measured by the vertical elutriator averaged 1.95, 1.80, and 1.51 milligrams per cubic meter for treatments G1, G2, and G3, respectively. With single carding (treatments M1 and M2), there was no measurable difference in cardroom dust level as a result of increasing the level of mill cleaning before carding. However, there was a 50-percent lower dust level during the second stage of carding than during the first stage (treatments M2 vs. M3).

Spinning Performance and Yarn Quality

Ring-spun yarns

The number of ends down per 1,000 spindle-hours during ring spinning varied over a wide range (table

Table 5.—Effects of gin- and mill-cleaning treatments on spinning performance and quality of ring-spun yarns[1]

Treatment[2]	Ends down (No./1,000 spindle-hours)	Break factor	Yarn appearance index	Single-strand strength (g/tex)	Single-strand elongation (pct)	Single-strand strength CV (pct)	Uster neps (No./1,000 yd)	Uster irregularity CV (pct)
Gin cleaning:								
G1	86c	1,843a	110a	12.5a	6.0a	12.0b	517c	23.1c
G2	243b	1,774b	110a	12.1a	5.9a	13.2a	602b	23.6b
G3	383a	1,733b	107a	12.1a	5.9a	13.2a	700a	24.4a
Mill cleaning:								
M1	199b	1,789a	108b	12.1a	6.1a	12.3b	685a	23.8a
M2	121b	1,797a	107b	12.4a	5.8a	12.5b	702a	23.7a
M3	391a	1,765a	112a	12.2a	5.9a	13.6a	432b	23.6a

[1]Each value is the average of 9 test lots. Means in a column for a given type of cleaning followed by different letters are significantly different at the 0.05 level.
[2]See table 1 for treatment descriptions.

Table 6.—Effects of gin- and mill-cleaning treatments on quality of open-end yarns and on rotor deposits[1]

Treatment[2]	Break factor	Yarn appearance index	Single-strand strength (g/tex)	Single-strand elongation (pct)	Single-strand strength CV (pct)	Uster neps (No./1,000 yd)	Uster irregularity CV (pct)	Rotor residue[3] (g/kg)
Gin cleaning:								
G1	1,851a	82.4a	10.4a	6.3a	8.9a	381a	14.2b	0.47a
G2	1,831ab	82.0a	10.4a	6.2a	9.0a	424a	14.5a	0.33ab
G3	1,814b	81.0a	10.3a	6.3a	9.5a	443a	14.4ab	0.25b
Mill cleaning:								
M1	1,833a	83.8a	10.4a	6.3a	9.0a	388a	14.4ab	0.55a
M2	1,836a	82.0a	10.3a	6.2a	8.8a	348a	14.2b	0.49a
M3	1,828a	80.0a	10.4a	6.2a	9.5a	511b	14.5a	0.01b

[1]Each value is the average of 9 test lots. Means in a column for a given type of cleaning followed by different letters are significantly different at the 0.05 level.
[2]See table 1 for treatment descriptions.
[3]Results of finisher-drawing-sliver samples processed on a Sussen Spintester.

5). Ends down increased significantly with each increase in gin-cleaning level, and the mill-cleaning treatment with double carding produced a significantly higher number of ends down than did the other two treatments with single carding. The number of ends down for gin-cleaning treatments G1, G2, and G3 averaged 86, 243, and 383, respectively. Mill-cleaning treatment M3 produced 391 ends down, as compared to 199 and 121 for treatments M1 and M2. The difference in ends down between the M1 and M2 cleaning levels was not statistically significant.

Yarn from gin-cleaning treatment G1 had a higher break factor (1,843) than did yarn from treatment G2 (1,774) or treatment G3 (1,733). Treatment G1 also produced a lower coefficient of variation for single-strand strength than did the other two-gin cleaning treatments. However, there were no significant differences among gin-cleaning treatments in yarn appearance, single-strand strength, or single-strand elongation. Uster neps and irregularity measurements increased significantly with each increase in gin cleaning, indicating that the increases in gin cleaning were adversely affecting yarn uniformity.

There were no significant differences in any of the yarn-quality measurements between mill-cleaning treatments M1 and M2. However, treatment M3 produced a higher yarn-appearance index and fewer neps than did treatments M1 and M2. Yarn from treatment M3 also had the highest coefficient of variation for single-strand strength.

Open-end yarns

The highest break factor for the open-end yarns was obtained with gin-cleaning treatment G1 and the lowest with treatment G3 (table 6). These break factors averaged 1,851 and 1,814, respectively. Also, treatment G1 tended to produce the most uniform yarns. The gin-cleaning treatments had no significant effect on yarn appearance index or on any of the single-strand yarn measurements.

The mill-cleaning treatments had no significant effect on any of the open-end yarn properties except Uster neps and irregularity. Treatment M3 produced more neps than did treatments M1 or M2, and treatment M2 tended to produce slightly more uniform yarn than the other mill treatments.

None of the cleaning treatments used in this experiment significantly affected the amount of residue in the rotors of the Platt open-end spinning frame. Generally, these residue deposits were small and averaged approximately 1 milligram per kilogram of yarn. To obtain additional information on the rotor-fouling potential of lint from the various cleaning treatments for other types of open-end spinning equipment, finisher-drawing-sliver samples were processed on a Sussen Spintester. The amount of rotor residue obtained in this test decreased with increases in level of gin cleaning, although only that difference between minimum gin cleaning (G1) and elaborate gin cleaning (G3) was statistically significant (table 6). Each level of gin cleaning decreased rotor residue deposits about 25 to 30 percent. There were no significant differences in residue deposits between mill-cleaning treatments M1 and M2, but treatment M3 with double carding was very effective in reducing these deposits. Rotor deposits resulting from use of double carding averaged only 0.01 gram per kilogram as compared to 0.49 and 0.55 gram per kilogram for the mill treatments with single carding.

SUMMARY AND CONCLUSIONS

Increased gin cleaning lowered foreign-matter contents of seed cotton at the feeder apron but had no effect on ginning rate. The normal and elaborate gin-cleaning treatments produced lower foreign-matter contents in ginned lint and cottonseed than did the minimum treatment, but there was no significant difference between the normal and elaborate treatments for these two measurements. Each increase in gin-cleaning level raised the classer's grade of about one-half of the test lots but had little effect on staple length or micronaire reading.

There was little difference in bale loan value between the minimum and normal gin-cleaning treatments. However, the elaborate cleaning treatment lowered bale-weights during seed-cotton cleaning. Also the elaborate treatment damaged more cottonseed than did the other two treatments. These results indicate that the amount of seed-cotton cleaning used in the elaborate treatment was excessive for this test cotton and that the amount of cleaning used in minimum treatment was insufficient to provide adequate cleaning. The results also suggest that, from a ginning performance standpoint, the normal gin-cleaning treatment was the most effective treatment for this test cotton.

Fiber-length measurements were affected slightly by gin-cleaning treatments, but fiber strength was not affected by any of the experimental treatments. Fiber length tended to decrease with increasing levels of gin cleaning, but length differences were generally small and only those differences in mean length of ginned-lint samples and 2.5-percent span length of finisher-drawing-sliver samples were large enough to be significant. Small differences in fiber length due to variations in mill cleaning were erratic.

There was no significant difference in processing waste between the normal and elaborate gin-cleaning levels, but the minimum cleaning level produced about 20 percent more processing waste than the other two treatments. Each increase in mill-cleaning level increased processing waste.

Cardroom dust levels decreased with increased gin cleaning, although the difference between minimum and normal gin cleaning was not statistically significant. The elaborate gin-cleaning treatment reduced cardroom dust levels about 16 percent when compared with the normal treatment. Increased mill cleaning before carding had no significant effect on cardroom dust level. However, the dust level during the second stage of carding was 50 percent lower than during the first stage.

Ends down during ring spinning increased significantly with each increase in gin cleaning, and the mill-cleaning treatment with double-carding produced a higher number of ends down than did the treatments with single carding.

Rotor residue decreased about 25 to 30 percent with each increase in gin cleaning. There was no significant difference in rotor deposits between mill-cleaning levels with one stage of carding, but the double-carding treatment was very effective in reducing these deposits.

Open-end and ring-spun yarns from the minimum gin-cleaning treatment were stronger and more uniform than yarns from the other two treatments. However, there was little difference among gin-cleaning treatments in yarn appearance and single-strand strength. Yarn quality was affected only slightly by mill-cleaning levels. For ring-spun yarns, the double-carding treatment produced a slightly higher yarn appearance index and fewer neps than the other mill treatments. However, for open-end yarns, it produced more neps than did the other mill treatments.

Generally, increased levels of gin and mill cleaning lowered cardroom dust levels and reduced rotor residue buildup but adversely affected ends down in ring spinning and quality of ring-spun and open-end yarns. Obviously, the cotton industry is faced with a trade-off situation with respect to increased gin and mill cleaning. Improvements in the dust-related problems have to be carefully weighed against any adverse effects of increased cleaning on spinning performance and yarn quality.

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