QUALITY IMPACT OF LOUVERS ON A 24-D LINT CLEANER

David D. McAlister, III
USDA-ARS
Cotton Quality Research Station
Clemson, SC
W. Stanley Anthony
USDA-ARS
Cotton Ginning Research Laboratory
Stoneville, MS
Earnest Edwards
Continental Eagle
Prattville, AL

Abstract

The purpose of this research was to establish the effectiveness of louvers installed on the 24D lint cleaner in terms of gin and mill performance. Previous research has shown that the use of available number of grid bars at a cotton gin results in improved value for the final product primarily by reducing the waste detected by the lint cleaner. 24-in. wide, glass-sided, 24-D lint cleaner was modified to add automated louvers. Two varieties of cotton were selected for comparison with the modified lint cleaner. These varieties were Deltapine 50 and Stoneville 4691B. Grid bar combinations utilized for each test per variety ranged from one to seven. Analysis of variance indicated that variety had a significant impact on nearly all factors, with the exception of lint moisture content. Grid bars had a significant effect on lint waste, leaf grade, HVI trash, Shirley Analyzer waste; AFIS dust count, AFIS trash count, AFIS visible foreign matter, and Opening and Cleaning waste. There was a significant effect of variety on Leaf grade, HVI Trash, SA waste, and Opening and Cleaning waste, making it necessary to consider these factors within each variety. With respect to opening and cleaning waste, the number of grid bars utilized significantly impacted the amount of waste generated. As for ring spun yarn quality and spinning efficiency, the number of grid bars utilized during ginning at the lint cleaner alone had no significant effect on either parameter.

Introduction

Previous research has shown that the use of available number of grid bars in a lint cleaner result in improved value for the final product primarily by reducing the waste ejected by the lint cleaner. Thus if foreign matter levels in the cotton after ginning are relatively low, then less than the standard 5-9 grid bars are required. The purpose of this research was to establish the effectiveness of louvers installed on the 24-D lint cleaner in terms of gin and mill performance.

Materials and Methods

A 24-inch wide, glass-sided, model 24-D lint cleaner initially constructed by Continental Eagle Corp. was modified to add automated louvers in 1999. The grid bars on the 24-D lint cleaner were rearranged to reduce the number from eight to seven and thereby allowing space to install louvers operated by pneumatic cylinders between grid bars. The modified 24-D, 24-in. wide, glass-sided lint cleaner was installed at the gin test facility in Prattville, AL.

Two varieties of cotton were selected for comparison with the 24-D lint cleaner. These varieties represented two available varieties at the Stoneville lab from the 2000 crop year that exhibited different levels of lint cleaner waste in comparative tests using the Continental 20-saw gin stand in the Microgin plant at Stoneville. These varieties were Deltapine 50 and Stoneville 4691B.

The ginning phase of the test was performed at the Continental Eagle gin research facility in Prattville, AL. Two bags of the appropriate variety were chosen at random for ginning at each level of grid bars utilized in the 24-D lint cleaner. Each bag was weighed and then fed to the feed control through a suction pipe. The entire sample was placed in the feed control before ginning commenced. Fractionation samples were taken at the wagon and again at the feeder apron. For each test (7), the proper settings were made for the number of grid bars to be utilized (from 1 to 7) by closing the appropriate louvers. The ginned lint for each condition was collected in bags at the press. Likewise, all lint cleaner waste was collected in a filter sock. Each grid bar combination test was repeated for each of the two varieties for a total of 28 tests. The machinery sequence for the ginning process was as follows:

1. Tower dryer – the burner was disconnected, thus no heat was available
2. Cylinder cleaner
3. Impact cleaner
4. Extractor-feeder
5. Gin stand
6. Lint cleaner (24D) with available grid bars

After ginning was complete, the lint for all 28 tests was shipped to the Cotton Quality Research Station at Clemson, SC for fiber testing and textile evaluation. Classification samples were sent to Dumas, AR, for evaluation and other samples for moisture, Shirley Analyzer, and fractionation were sent to the Cotton Testing Laboratory at Stoneville, MS for evaluation. At textile processing, cotton was processed for ring yarn spinning through the following machinery:

1. 3 blend hoppers
2. Axiflo
3. GBRA
4. RN
5. RST
6. DX
7. DK803 Card (60gr @ 100Lbs/hr)
8. RSB Drawing (2 passes, 53gr 1st pass, 6 ends & 55 gr 2nd pass, 8 ends @ 450m/min)
9. Zinser 660 Roving (1 Hk, 1.3 TM, @ 950 rpm)
10. Zinser 321 Ring Spinner (30/1, 3.75 TM, @ 16,000 rpm)

Raw stock samples (one pound each) and one-half pound of sliver at carding and drawing were collected for fiber testing for every condition. In addition, all yarn was tested for strength, uniformity and defects for each condition.

Results and Discussion

Means are separated by the Waller-Duncan procedure for the gin, and AFIS data in Tables I and II, respectively. Likewise, the means for the HVI, Processing, and Yarn Quality data are listed in Table III. Lint waste adjusted for a 500-Lb. bale, ranged from 9.1 Lbs. for one grid bar to 25.4 Lbs. for six grid bars (seven grid bars was 22.7 Lbs. and not significantly different from the 25.4 Lbs.). Lint waste decreased as has been demonstrated in previous research as the number of grid bars utilized were decreased and exhibits a strong correlation as shown in Figure 1. Lint waste was significant for the variety and grid bar interaction at the 0.08 level--suggesting a need to use a different number of grid bars for different cottons based on lint waste. All other correlations discussed are significant at the 0.05 level or higher.

As indicated in Table III, there are no significant increases in HVI trash measurement even though there exist a strong correlation between HVI trash and number of grid bars utilized as shown in Figure 2. However, classer leaf grade increases, as the number of grid bars utilized is decreased with a strong correlation as shown in Figure 3. Additionally, in Table II, the AFIS dust count and trash count and visible foreign matter (VFM) is also significantly increased as the number of grid bars utilized is decreased and like leaf and trash measurements, have a strong correlation with the number of grid bars utilized (Figures 4, 5 and 6).

As might be expected based on the HVI and AFIS data discussed above, the amount of waste generated in yarn processing should increase significantly as the number of grid bars utilized are decreased as is shown in the increases in Shirley Analyzer (SA) waste and opening and cleaning waste in Table III. Even with the increases in opening and cleaning waste generated during yarn processing as a result of reducing the number of grid bars utilized, ring spinning efficiency and yarn quality were not significantly impacted. However, there is a strong relationship between the number of grid bars utilized and the amount of waste generated by SA and Opening and Cleaning (Figures 7 and 8).

Further analysis of the leaf, HVI trash, and SA waste by variety, reveals that the Stoneville 4691 variety (hairy leaf) has stronger relationships between these fiber properties and the number of grid bars utilized (Figures 9, 10 and 11). Variety did not have quite the impact on Opening and Cleaning waste data as far as correlation with the number of grid bars utilized. However, the Stoneville 4691 resulted in higher levels of Opening and Cleaning waste far above the 1.5-2.0 % levels that are typical in mill processing. As for the Delta and Pineland 50 variety (smooth leaf), virtually all combinations of gridbars utilized result in typical levels of Opening and Cleaning waste generated (Figure 12). These correlations suggest that the optimum number of grid bars utilized on a lint cleaner could be variety dependent. It is recommended that a further evaluation of the optimal grid bar utilization be looked at closely within variety and studied relative to the four major spinning systems.

Summary

The purpose of this research was to establish the effectiveness of louvers installed on the 24D lint cleaner in terms of gin and mill performance. Previous research has shown that the use of available number of grid bars at a cotton gin results in improved value for the final product primarily by reducing the waste detected by the lint cleaner. 24-in. wide, glass-sided, 24-D lint cleaner was modified to add automated louvers. The modified lint cleaner was then installed in a gin facility in Prattville, AL. Two varieties of cotton were selected for comparison with the modified lint cleaner. These varieties were Deltapine 50 and Stoneville 4691B. Grid bar combinations utilized for each test per variety ranged from one to seven. Ginned lint was sent to the Cotton Quality Research Station at Clemson, SC for fiber and yarn spinning tests. Analysis of variance indicated that variety had a significant impact on nearly all factors, with the exception of lint moisture content. Grid bars had a significant effect on lint waste, leaf grade, HVI trash, Shirley Analyzer waste; AFIS dust count, AFIS trash count, AFIS visible foreign matter, and Opening and Cleaning waste. There was a significant effect of variety on Leaf grade, HVI Trash, SA waste, and Opening and Cleaning waste, making it necessary to consider these factors within each variety. With respect to opening and cleaning waste, the number of grid bars utilized significantly impacted the amount of waste generated. As for ring spun yarn quality and spinning efficiency, the number of grid bars utilized during ginning at the lint cleaner alone had no significant effect on either parameter. Still, given the interaction between grid bars and variety, variety had the best correlations with leaf, HVI trash, and Shirley Analyzer Waste. Opening and Cleaning waste levels were higher than industry norms for the Stoneville 4691 variety. Larger studies to fully capture the effect of varieties and the impact on other spinning systems will be required in order to completely evaluate the potential for louvered lint cleaners.

Disclaimer

References

Anthony, W.S. 1999. Can lint cleaner waste be reduced? Proc. of the Beltwide Cotton Conferences 2: 1403-1406.

Table 1. Means for Gin data (Stoneville) by grid bars utilized separated by Waller-Duncan.

Means for	**Number of Grid Bars**							
Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**MSD[1]**
Lint Waste	9.1e	17.21cd	15.43d	21.38abc	20.36bcd	25.36a	22.67ab	4.49
Turnout	32.32ab	32.54ab	32.68a	32.03b	31.96b	31.92b	32.10ab	0.65
Frac. Wagon	3.63a	3.68a	3.92a	3.82a	4.01a	3.71a	3.68a	0.62
Frac. Feeder	6.71a	7.06a	6.89a	7.64a	6.81a	7.28a	6.72a	1.21
Lint Moisture	5.48a	5.71a	5.73a	5.56a	5.41a	5.53a	5.89a	1.54

[1] Minimum Significant Difference.

Table 2. Means for AFIS data (Stoneville) by grid bars utilized separated by Waller-Duncan.

Means for Variable	Number of Grid Bars							
	1	2	3	4	5	6	7	MSD[1]
Mean Length	0.97a	0.98a	0.97a	0.97a	0.97a	0.97a	0.97a	0.01
UQL	1.17a	1.17a	1.17a	1.17a	1.17a	1.17a	1.17a	0.01
SFC	8.12a	8.00a	7.97a	8.00a	8.14a	7.80a	8.11a	0.62
Length, 5%	1.32a	1.32a	1.32a	1.32a	1.31a	1.31a	1.32a	0.01
Length, 2.5%	1.40a	1.41a	1.40a	1.40a	1.40a	1.40a	1.40a	0.02
Fineness	175.05a	174.55a	174.60a	174.70a	174.15a	175.30a	174.25a	4.44
IFC	3.62a	3.76a	3.84a	3.80a	3.85a	3.64a	3.76a	0.50
Maturity Ratio	0.88a	0.88a	0.88a	0.88a	0.88a	0.88a	0.88a	0.02
Neps/g	294.70a	290.90a	290.40a	289.60a	310.40a	295.90a	302.00a	26.04
SCN/g	21.95a	22.75a	22.75a	20.40a	22.15a	20.35a	21.50a	6.11
Trash size	342.65a	342.95a	349.20a	343.85a	345.65a	343.45a	350.70a	13.41
Dust count	760.60a	709.05ab	727.20ab	655.70bc	600.60cd	568.75cd	560.65d	90.59
Trash count	161.80a	153.30a	158.85a	139.55ab	128.55b	123.35b	123.45b	23.06
VFM	3.11a	2.90ab	3.03a	2.62abc	2.43bc	2.30c	2.45bc	0.50

[1] Minimum Significant Difference.

Table 3. Means for HVI, AFIS, Yarn Processing and Quality data (Clemson) by grid bars utilized separated by Waller-Duncan.

Means for Variable	Number of Grid Bars							
	1	2	3	4	5	6	7	MSD[1]
UHML	1.09a	1.09a	1.09a	1.09a	1.09a	1.08a	1.09a	0.01
Uniformity	81.18a	81.20a	81.08a	81.15a	81.23a	80.65a	81.03a	0.61
Leaf	4.50a	4.50a	4.38a	4.10ab	3.75b	4.15ab	3.90b	0.42
Mic	4.09a	4.02a	4.07a	4.04a	4.10a	3.99a	4.09a	0.13
Trash	0.67a	0.59a	0.63a	0.54a	0.52a	0.51a	0.52a	1.66
Strength	26.07a	25.92a	26.02a	25.84a	26.22a	25.90a	25.80a	0.59
HVI Color Grade								
Index	87.00a	85.75a	87.00ab	87.00ab	91.50a	89.25ab	89.25ab	4.69
Color: Rd	69.78bc	69.20c	69.70bc	70.20ab	70.75a	70.15ab	70.58ab	0.88
Color: +b	8.81a	8.89a	8.94a	8.91a	8.95a	8.93a	8.92a	0.16
S.A. Waste	3.93a	3.80a	3.63a	3.03b	2.98b	2.95b	2.95b	0.34
Opening & Cleaning								
Waste	2.32a	1.93b	2.00b	1.75cd	1.87bc	1.60de	1.49e	0.17
Card Waste	3.33a	3.43a	3.45a	3.42a	3.24a	3.27a	3.26a	0.50
Ends Down	26.50a	32.50a	39.75a	54.25a	21.75a	30.25a	24.25a	54.60
Yarn SES	14.90a	14.91a	14.87a	14.87a	15.00a	14.47a	14.71a	0.92
Yarn SEE	6.42a	6.19a	6.35a	6.40a	6.22a	5.98a	5.95a	1.17
Yarn CVm	19.58a	19.45a	19.60a	19.45a	19.55a	19.48a	19.50a	0.76
IPI neps	547.3a	717.8a	487.0a	711.3a	696.8a	585.0a	527.8a	492.6
IPI thick	1016.3a	1312.5a	968.3a	1328.3a	1315.8a	1091.0a	1081.8a	746.67
Classimat								
Major	15.50a	14.25a	19.50a	8.00a	10.50a	14.50a	13.75a	20.03
Minor	2281.8a	3165.8a	2733.0a	2156.8a	2466.5a	2650.5a	1834.0a	2870.5
Long thick	50.5a	76.0a	64.8a	22.0a	336.5a	90.8a	53.0a	481.99
Long thin	1113.8a	1343.8a	1116.5a	867.5a	1280.8a	1295.0a	1220.5a	1342.9

[1] Minimum Significant Difference.

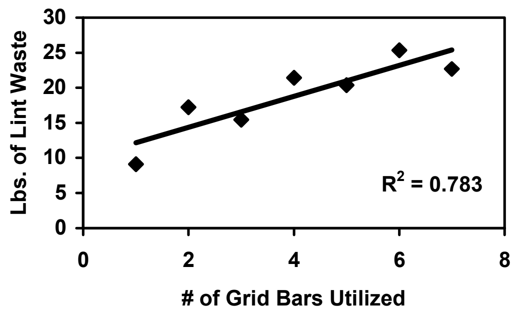

Figure 1. Effect of Grid Bars on Lint Waste.

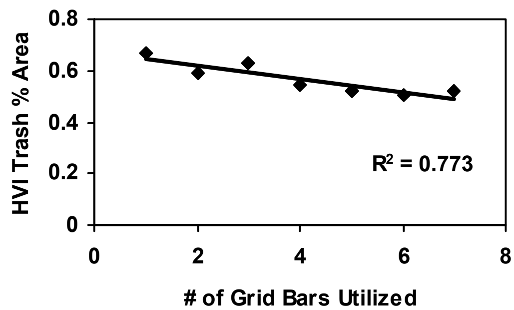

Figure 2. Effect of Grid Bars on HVI Trash % Area.

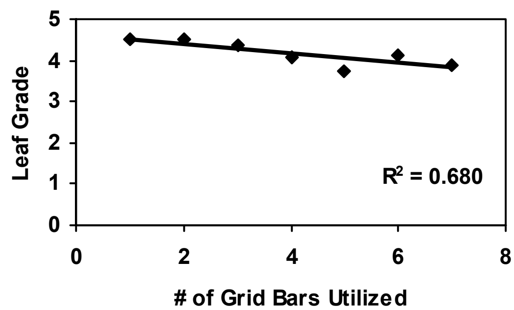

Figure 3. Effect of Grid Bars on Leaf Grade.

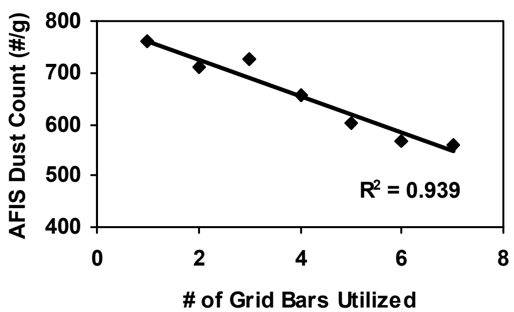

Figure 4. Effect of Grid Bars on AFIS Dust Count.

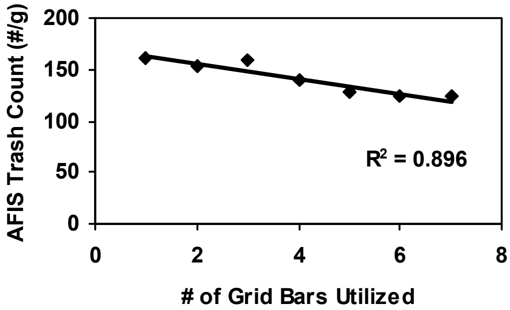

Figure 5. Effect of Grid Bars on AFIS Trash Count.

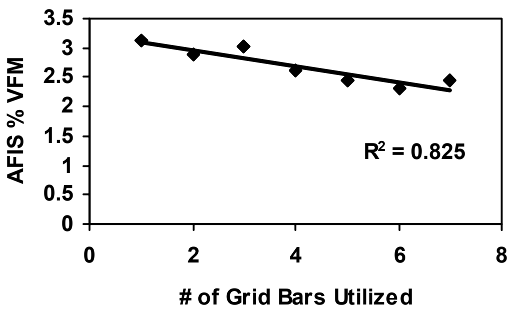

Figure 6. Effect of Grid Bars on AFIS Visible Foreign Matter (VFM).

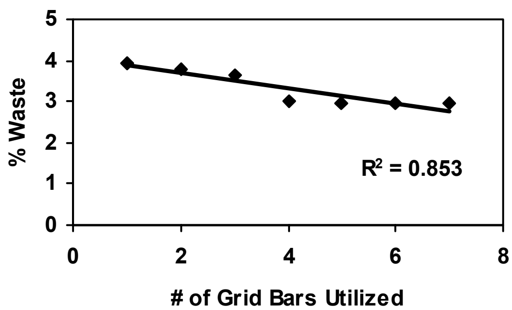

Figure 7. Effect of Grid Bars on Shirley Analyzer Waste (Total).

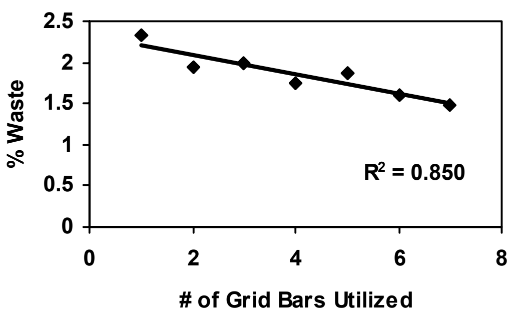

Figure 8. Effect of Grid Bars on Opening and Cleaning Waste.

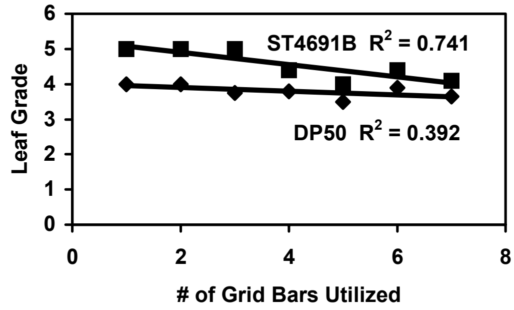

Figure 9. Effect of Grid Bars on Leaf Grade by Variety.

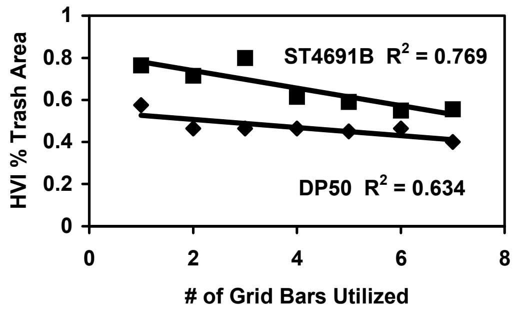

Figure 10. Effect of Grid Bars on HVI Trash % Area by Variety.

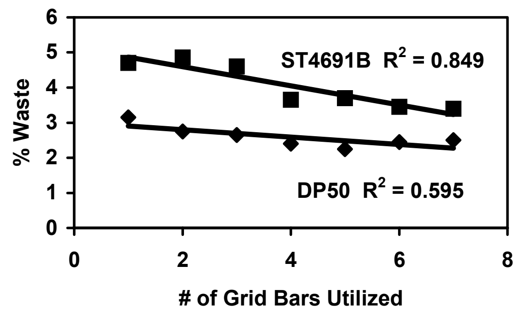

Figure 11. Effect of Grid Bars on Shirley Analyzer Waste (Total) by Variety.

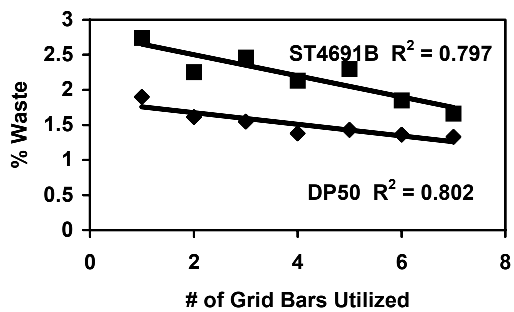

Figure 12. Effect of Grid Bars on Opening and Cleaning Waste by Variety.