2005 Beltwide Cotton Conferences, New Orleans, Louisiana - January 4 - 7, 2005

MOTORIZED GRID BAR IN A LINT CLEANER ENHANCE LINT VALUE

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Abstract

As the volume of cotton processed in cotton gins grows, so does the need for tighter control over the process and more specifically the grade of the lint produced. The system described below includes motorized grid bars. The Grid bars which are the main instrument involved in the cleaning of the lint, after seed removal, can be manipulated electronically such that the amount of cleaning can be matched to the need at any time during the process. Furthermore, optical devices, such as cameras, are used to evaluate the amount of trash present in the lint and supply that information to the operator for him to decide what amount of cleaning should be applied. Test performed confirmed that the proposed system can save the producer through the increase turnout and improved lint properties. At the Lyford Gin (Lyford, TX) the installed system provided financial benefits of over $10 per bale per test performed at that location in the summer 2004.

Introduction

Our systems help make gin operation more efficient and increase the value of the lint for the producers.

Our objectives:

- Increase Turn Out
- Better control on leaf grade
- Improve staple
- Increase producer income

The Systems we offer provide solutions in the following areas:

Lint Cleaner control - the Lintoptimizer(tm)
Variable rate cleaning for maximum product value
Leaf grade measurements and control
Enhanced grid bars performance

Variable Rate Lint Cleaner - System Description

The operating speed of the cleaners has traditionally been the only parameter the ginner can control by simply manipulating the incoming voltage or the frequency of the incoming electrical supply. Otherwise, almost all lint cleaners are designed as *invariant* machines. Their operating parameters do not change during the cleaning process, regardless of the lint they process or any other measures of it. The Variable Rate Lint cleaning concept was designed to allow the ginner to adjust the cleaning process to the need of the fiber. Clean cotton need not to be cleaned as much as lint with significant amounts of leaf and trash. The ability to adjust the cleaning in real time allows the ginner to fine tune the grade of the lint he process. The cleaning grid bars in the new machines are motorized, allowing the ginner to engage or disengage each of them with the cleaning process. In such method the machine can be tuned to the level of cleaning required for a specific type of lint in process. The adjustment is done in real time, while the cleaner is operating.

The Variable Rate lint cleaning system consists of the following components (subsystems):

Operator terminal (Figure 1)

The Operator terminal allow the operator to monitor and control the cleaning process. Shown in the image is the operator screen where he has real time information on the grade of the lint and the position of the grid bars. He also has the ability to set a desired leaf grade for automatic operation or to control the grid bars manually.

Real time images of the lint before and after cleaning are taken by the system cameras, and displayed on the screen. The processed images, showing the trash as black clusters can also be displayed. The leaf grade is estimated and presented to the operator in a summary table at the bottom of the screen.

The system can be operated in MANUAL or AUTOMATIC mode. In the AUTO mode the ginner can set a desired leaf grade and the control system will automatically adjust the grid bars positions for best match. In MAN mode the ginner has the ability to engage or disengage the grid bars to fit his own desire using the terminal control buttons.

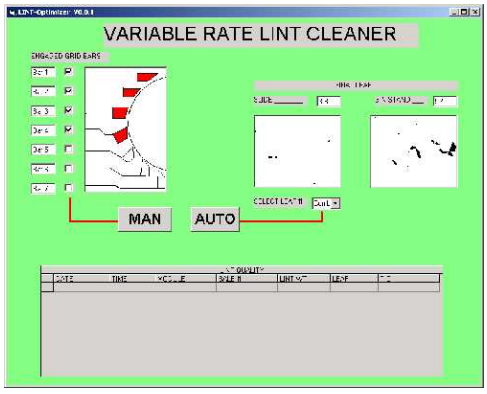

Figure 1. Operator terminal

Motorized grid bar system (Figure 2)

The motorized grid bar sub system is the mechanical components which manipulate the grid bars to their engaged or disengaged positions. The position of each of the grid bars can be adjusted individually by the ginner or automatically by the control system. Shown in the image are the pivoting grid bars and the pneumatic cylinders which manipulate them to their position. The grid bars are positioned on a pivot, and are capable of moving into engaged position or to a disengaged position.


Figure 2. Motorized grid bars

Optical leaf grade sensors (Figure 3)

Cameras are used to estimate the leaf grade of the lint before and after cleaning. These reading are displayed to the operator and are also used by the controller to run the system in an automatic mode. The images are sent to the central processing unit for display and analysis. Leaf grade and trash level are estimated and presented to the operator.

Figure 3. Camera for leaf grade images.

Processor and PLC

The system is operated by a main processor and a programmable control. Their function is to monitor lint leaf grade and control the operation of the grid bars.

The Processing system consists of a network of computers and controllers which perform the various data collection, monitoring, analysis, display and storage. It includes the multiple cameras, lint sensors, flow monitors and method for collection of bale serialization, weight, moisture and other parameters. The main data processing unit determines the desired position of the grid bars and sends the appropriate command to the Controller for execution.

Test

The cleaning point of the bar was designed to rotate of a central axis so it could be removed from the cleaning area. This prototype was manually operated. The system was installed on an 86" lint cleaner at Terry County Coop Gin, Brownfield, Texas during the 2003 ginning season. Initial observations showed that the rotation of different sequences of grid bars has a dramatic effect on cleaning efficiency and the amount of fiber lost. It was concluded that a lint saver would need to be added to prevent excessive fiber loss when each gird bar was disengaged.

Two subsequent prototypes were manufactured and installed in July 2004 at Lyford gin, Lyford, TX. Movement of the grid bars was achieved by incorporating pneumatic cylinders controlled by electric solenoids. The solenoids were coupled with a controller that allows for manual manipulation of each grid bar positioning.

Five tests were conducted on same cotton variety which had same treatment:
Test 1 was conducted on the original lint cleaner of the gin containing 7 grid bars.
Test 2 was conducted with the new grid bars configuration were all grid bars were engaged.
Test 3 was conducted with the new grid bars configuration were all grid bars but #6 were engaged.
Test 4 was conducted with the new grid bars configuration were all grid bars but #4 were engaged.
Test 5 was conducted with the new grid bars configuration were all grid bars but #2 were engaged.
For clarification, grid burs are counted from the top.

Results

The table below discloses the classing and loan value for the listed tests. It can be noticed that the new grid bar system cleans better then the standard. The turn out for test 3 was higher then the others. The staple for test 3, 4 and 5 were better then #1 and #2.

Average Data from Test			Avg	Avg	Avg	Avg	Avg		Avg	Avg	Avg
Test #	Mod. Wt.	Net Lint	Turnout	Grade	Leaf	Staple	Mic		Strength	Uniformity	Loan
test 1(base)	9,480	3,107	32.77%	36.33	3.83	37.17	45.17		33.82	82.67	0.533
test 2	13,160	4,300	32.67%	31.00	3.00	37.11	44.88		31.61	82.75	0.565
test 3	10,480	3,504	33.44%	31.00	3.43	37.43	45.14		32.20	83.14	0.56
test 4	11,080	3,547	32.01%	31.00	4.00	37.75	44.13		32.84	82.63	0.549
test 5	12,660	4,015	31.71%	31.00	4.00	37.22	42.44		33.17	83.11	0.547

The table below summarizes the financial benefits resulting from the operation of the system. Significant gain was achieved with most of the configurations.

	total Benfit $/bale	Loan Benefit $/bale
test 1 (base)	0	0
test 2	14.71	15.81
test 3	18.79	13.47
test 4	1.6	8.01
test 5	-1.61	7.2

Conclusions

It was shown that the new grid bar cleaner design has demonstrated improvement over the standard system. The small number of test is not statistically sufficient to make definite statements about the benefits of the system however a clear trend is visible. Additional test will be performed in the coming year to obtain greater mounts of data to qualify and quantify this new design.

References

R. V. Baker, A. D. Brashears; Effects of Grid and Saw Variables on Lint Cleaner Performance; Transactions of the ASAE 1989

W. Mayfield, R.V. Baker; Effects of Grid Bars On Lint Cleaner Performance; The Cotton Gin and Oil Mill Press; June 13, 1992