The *Journal of Cotton Science 15:43–51 (2011)*
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ENGINEERING AND GINNING

Evaluation of Select Equipment Sequences for Optimal Fiber Recovery from Stripper-Harvested Gin Waste

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ABSTRACT

Previous studies evaluating the constituents of gin waste indicated 10 to 25% of the total mass consisted of recoverable fibers that have the potential to be marketed as gin motes. As a result of these findings and of practical experience from a commercial cotton gin, questions arose as to the best sequence of cotton gin precleaning equipment needed to recover the largest quantity of mote quality fibers. In this study, nine machinery layouts were evaluated to determine the sequence that produced the largest quantity of the cleanest marketable fibers. The precleaning machinery evaluated included gravity feeding, separators, cylinder cleaners, and extractors. Results indicated that the cleanest marketable fibers were produced by machine sequences that contained at least one extractor (i.e., stick and burr machine). In addition, Advanced Fiber Information System (AFIS) data were also obtained on all fibers reclaimed from each layout. The AFIS data revealed short fiber contents ranging from 23 to 30% by weight and 53 to 63% by number and indicated significant differences (p value ≤ 0.05) for some of the fiber properties. Due to the quality of the fibers recovered, the AFIS data were not used in selecting one treatment over another. An economic analysis using a range of gin mote prices, ginning capacities, and fiber recovery rates suggested that desirable potential revenues for gins of 40,000 bales/yr and higher are possible.

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Separating the extraneous biomass from cotton lint and cottonseed in cotton gins, commonly referred to as gin waste or gin trash, into its various components of sticks, burrs, leaf, fibers, and other organic constituents (i.e., sand, soil, and miscellaneous small particle organic matter) revealed beneficial characteristics and physical properties beyond those experienced when all the constituents were not separated (Holt et al., 2000). The extraneous biomass from cotton gins termed gin trash/gin waste is underutilized biomass referred to as cotton gin byproducts (CGB). The benefits gained from separating CGB into individual components (Holt et al., 2000) were the impetus behind the COBY Process (Holt and Laird, 2002) and numerous other research studies investigating the potential use of CGB for applications ranging from a value-added roughage in livestock feed (Holt et al., 2003), raw material in the manufacture of a hydromulch (Holt et al., 2005a, 2005b), fuel pellet used for heating homes and small businesses (Holt et al., 2006), and a raw material for composites boards (Bajwa et al., 2009; Holt et al.,2009).

Holt and Wedegaertner (2007) reported on a study that focused on using CGB as a fuel where gin waste from four gins (two from West Texas and two from the southern US) was reprocessed through conventional seedcotton precleaning equipment. One of the findings associated with the 2007 study revealed that, on average, 15% of the total weight of CGB was recoverable fibers. These recovered fibers were examined by a local mote buyer and determined to be satisfactory for inclusion into a cotton gin's existing gin mote baling system and possibly a satisfactory substitute for gin motes.

Motes are defined as "immature seed with short, immature fiber attached" (Anthony and Mayfield, 1994) or "undeveloped fibers" (Goynes et al., 1995). In the ginning process, motes are primarily associated with fibers discarded from the gin stand (i.e., lower gin motes) and/or from the lint cleaners (i.e., the lint side of the process) and not the precleaning equipment (i.e., seedcotton side of the process). It is rare for a cotton gin not to bale motes because motes are a marketable product. If a cotton gin did not bale motes, the quantity of residual lint in the CGB would significantly increase. For a gin that bales lint cleaner motes, the residual fibers in the CGB would primarily be from fibers that slipped through grid bars and/or screens of the precleaning equipment during cleaning of the seedcotton.

In conjunction with gin waste fiber reclamation studies conducted at the Cotton Production and Processing Research Unit (CPPRU) in Lubbock, TX, (Holt and Wedegaertner, 2007) field studies were conducted by Charley Knabb at Three-Way Gin in Tunica, Mississippi. The results from these studies were presented at two of the three gin schools conducted by the National Cotton Ginners Association in 2008. Attendees of the gin school fiber reclamation presentations asked questions that focused primarily on the most effective sequence of cotton gin precleaning equipment to reclaim the most fibers from CGB. As a result of the questions received from attendees of the gin school, a study was initiated to evaluate which precleaning machinery sequences could extract the largest quantity of clean fibers (i.e., residual lint) from CGB. Thus, the primary objective of this study was to evaluate different gin machinery configurations to see which one(s) recovered the largest quantity of the cleanest (i.e., most marketable) fibers from CGB. A secondary objective was to determine if the different machinery configurations had an impact on the quality of fiber recovered.

MATERIALS AND METHODS

Setup and Testing. The CGB used in this study was produced by a commercial cotton gin in West Texas during the 2007-08 ginning season. The fibers evaluated in this study were those recovered from CGB discarded from the cotton gin's precleaning equipment (i.e., before the gin stand), and therefore contained small quantities of seedcotton. Because the gin from which the CGB was obtained bale their motes (i.e., lint cleaner waste), the CGB used in this study did not include lint cleaner waste. Once obtained, the CGB was stored in cotton trailers in a storage shed until processing. Processing of the CGB consisted of running the material through different equipment in the seedcotton precleaning line of the CPPRU cotton gin lab. Nine different equipment sequences (treatments) were evaluated using 1.8-m (72-in) wide equipment. The equipment used consisted of Hardwicke-Etter (Hardwicke-Etter Co., Sherman, TX) separators with a screen hole size of 0.635 cm (1/4 in); HE cylinder cleaners (7 cylinders) with 0.952-cm (3/8 in) grid bars spaced 0.952 cm (3/8 in) apart; a Lummus (Lummus Corporation, Savannah, GA) S&GH extractor, and a Consolidated (Consolidated Cotton Gin Co, Ltd., Lubbock, TX) Rescuer 320 extractor. The treatments evaluated and equipment used were:

- Separator (HE) - Cylinder Cleaner #1(HE) – Cylinder Cleaner #2(HE),
- Separator (HE) – Cylinder Cleaner #1(HE) – Separator (HE) – Cylinder Cleaner #2(HE),
- Separator (HE) – Extractor (S&GH) – Cylinder Cleaner #2(HE),
- Separator (HE) – Extractor (S&GH) – Separator (HE) – Cylinder Cleaner #2(HE),
- Cylinder Cleaner #1(HE) – Cylinder Cleaner #2(HE),
- Cylinder Cleaner #1(HE) – Separator (HE) – Cylinder Cleaner #2(HE),
- Extractor (S&GH) – Cylinder Cleaner #2(HE),
- Extractor (S&GH) – Separator (HE) – Cylinder Cleaner #1(HE), and
- Separator (HE) – Extractor (S&GH) – Separator (HE) – Extractor (Rescuer).

In addition to the equipment used, another important difference between the treatments was how the CGB was fed into the machines; some treatments used air conveyance and separation (Separator), whereas others were gravity fed. In the list of the nine treatments above, the machines that do not have a separator immediately preceding were gravity fed. For the treatments where separators were used, the material was conveyed in an airstream to a condenser and the air passed through the condenser screen to a cyclone. For the cylinder cleaners, air was pulled off the belly of the machines for each test. Each test run processed approximately 159 kg (350 lb) of CGB at an average rate of 100 kg/min (220 lb/min). The average temperature during testing was 17°C (63°F) with a relative humidity of 86%.

Data Collection. The data recorded for each run consisted of: 1) time of day, 2) time of run, 3) ambient temperature, 4) relative humidity, 5) weight of CGB used, 6) moisture content of CGB, 7) quantity of waste from each machine, and 8) quantity of reclaimed fiber (End Catch/ End Weight). After each run, three subsamples of the recovered fiber were collected. One sample was sent to Cotton Incorporated's facility in Cary, NC for Shirley (ASTM, 2002) and Advanced Fiber Information System (AFIS) analyses, one sample fractionated (Shepherd, 1972) at CPPRU, and one sample retained as backup. The fractionation analysis divided the End Catch recovered fiber sample into three categories: 1) fibers, 2) sticks and burrs, and 3) fines.

Experimental Design and Data Analysis. This study was a completely randomized design with nine treatments replicated three times. Standard analysis of variance techniques were used to determine the statistical significance among the treatments using Ryan-Einot-Gaberiel-Welsch multiple range test at the 95% confidence interval (release 9.1.3, SAS Institute Inc., Cary, NC). The response variables evaluated from the data included: 1) Final Weight (End Catch/ End Weight), 2) Lint Recovery (Fractionation), 3) AFIS data, and 4) Shirley Analysis.

Economic Analysis. An economic evaluation calculating Internal Rate of Return (IRR), payback, and potential revenue, was conducted for labor and energy using the following assumptions: 1) maximum power requirement to recover fiber from the CGB is 74.6 kWh (100 hp); 2) electrical cost is 10 cents/kWh; 3) maximum additional labor required = 0.5 person; 4) quantity of CGB produced from a bale of cotton = 181.4 kg (400 lb); 5) the gin is operating for 120 days; 6) Minimum Attractive Rate of Return (MARR) = 10%; and 7) a range of machinery capitalization cost of $90,000 to $240,000 in increments of $30,000. The analysis was performed for ginning capacities of 20,000 to 80,000 bales/yr using marketable fiber recovery rates of 5 to 15% by weight of CGB in 2% increments. The price of the recovered fiber was evaluated using a range of $0.11/kg to $0.33/kg ($0.05/lb and $0.15/lb) in increments of $0.009/kg ($0.02/lb). Bale ties, bale wrap, and additional transportation were not included in the analysis.

RESULTS AND DISCUSSION

The average moisture content of the CGB evaluated was 8.4% (ASTM, 2006).

Table 1 contains the percent of initial material that made it through the treatment (i.e., End Catch) along with the amount of lint and trash contained in the End Catch from fractionation. Treatments 6 and 1 contained the largest quantity of material recovered, 42.2 and 40.7%, respectively (Table 1). The least quantity of material recovered was from Treatments 9 and 4, respectively. The data show that End Catches larger than 20% were obtained for all treatments where two cylinder cleaners were used (Table 1). However, the same cylinder-cleaner-only treatments also showed trash contents in excess of 70% and lint contents below 30%. Thus, using only cylinder cleaners resulted in a sample laden with extraneous debris and fibers that were deemed by the authors, insufficiently clean to go to the mote press without additional processing. It should be noted that there is not a written standard for what constitutes clean motes; it is a subjective measure of the mote buyer. The End Catch samples in this study were shown to a local mote buyer for a professional opinion as to the whether or not the samples were satisfactory for inclusion in the mote bale. The mote buyer agreed with the authors' opinion that the cylinder-cleaner-only treatments had too much foreign matter remaining in the fibers and needed more cleaning. A visual reference for mote classifications can be found in Ray and Anthony (2006). Contrary to the cylinder-cleaner-only treatments, all End Catch samples from treatments containing at least one extractor produced samples with less extraneous debris and lint contents ranging from 36 to 69%. Overall, the treatment with two extractors, Treatment 9, produced significantly more lint and less trash than any of the other treatments. The treatments with the highest average trash contents in the End Catch were Treatments 5, 6, and 2 with trash contents of 80, 79, and 78%, respectively.

The AFIS data that exhibited significant differences for the treatments evaluated are shown in Table 2. The AFIS data were obtained by Cotton Incorporated by processing the samples through the Shirley analyzer and then analyzing the cleaned fibers. Due to the low fiber quality of the recovered fibers, such as the high Short Fiber Content (SFC) (i.e., > 23% SFC by weight and > 52% by number), it is not recommended that these fibers be included in the lint bales. However, the recovered fibers where deemed suitable for inclusion into the gin's mote bales by a local mote buyer. The mote buyer did prefer the cleaner lint samples (i.e., Treatments 3, 4, 7, and 9) to those with more foreign matter remaining in the lint. Whether or not mixing the reclaimed fibers from CGB, which can contain locks of seedcotton, into the mote bales is acceptable is a matter that needs to be taken up with an individual cotton gin's mote buyer.

Table 1. Recovered fiber and trash data from hand fractionation of cotton gin byproducts (gin trash) processed through the nine different treatments evaluated in this study.

Treatment	Equipment Sequence[z]	End Catch (% of Total)[y]	Fractionated Lint in End Catch (%)[x]	Fractionated Trash in End Catch (%)[w]
1	Sep, Cyl, Cyl	40.7	27.9d	71.5b
2	Sep, Cyl, Sep, Cyl	34.6	21.3de	77.8ab
3	Sep, Ext, Cyl	14.7	58.2b	36.0e
4	Sep, Ext, Sep, Cyl	13.9	55.2b	42.5de
5	Cyl, Cyl	32.1	18.8e	80.5a
6	Cyl, Sep, Cyl	42.2	19.4de	78.7ab
7	Ext, Cyl	16.4	49.9b	46.7d
8	Ext, Sep, Cyl	16.6	36.2c	59.4c
9	Sep, Ext, Sep, Ext	13.5	68.7a	25.9f

[z] Sep = Separator; Cyl = Cylinder Cleaner; Ext = Extractor.

[y] End Catch is the percent of the total input that made it through the processing equipment without being discarded into the waste streams of the processing equipment.

[x] Fractionated Lint in the End Catch is the average percent fibers recovered as a result of hand fractionation of three samples. Means in the same column followed by different letters are significantly different at the 95% confidence limit.

[w] Fractionated Trash in the End Catch is the average percent fines, sticks, and burrs recovered as a result of hand fractionation of three samples. Summations of the fractionated lint and the fractionated trash that are less than 100% are the result of “invisible loss”. Means in the same column followed by different letters are significantly different at the 95% confidence limit.

Table 2. Advanced fiber quality information system (AFIS) data for the fiber recovered from the cotton gin byproducts (gin waste) processed through the nine treatments evaluated in this study.

Treatment[z]	Nep Size (um)	Neps (cnt/gm)	Lw (cm)[y]	Ln (cm)	UQL (cm)	SFCw (%)	SFCn (%)	SCN (cnt/gm)
1	776b	1754c	1.99ab	1.35a	2.67a	23.6b	52.9c	104b
2	789ab	2467ab	1.85c	1.17c	2.52b	30.5a	62.2a	141ab
3	774b	1908bc	2.02a	1.32ab	2.68a	23.3b	54.3bc	105b
4	772b	2101bc	1.96abc	1.22bc	2.65a	26.6ab	59.2ab	118b
5	778b	2174bc	1.92abc	1.22bc	2.61ab	27.6ab	59.3ab	116b
6	776b	2219bc	1.94abc	1.27abc	2.59ab	26.2ab	56.5abc	120b
7	778b	1978bc	1.86c	1.16c	2.51b	29.9a	62.2a	113b
8	781ab	2099bc	1.88bc	1.18c	2.54b	28.8a	60.8a	117b
9	803a	2766a	1.89bc	1.14c	2.58ab	29.0a	62.6a	166a

[z] Means in the same column followed by different letters are significantly different at the 95% confidence limit.

[y] L = length by weight (w) and by number (n), UQL = Upper Quartile Length, SFC = Short Fiber Content by weight (w) and by number (n), and SCN = Seed Coat Neps.

Treatment 9 produced the cleanest recovered fiber (Table 1), but it had significantly higher neps, seed coat neps (SCN), SFC, and shorter fiber lengths than some of the other treatments (Table 2). Unlike the trends seen in Table 1 with the cylinder-cleaner-only treatments having higher trash and lower lint content and treatments with extractors having higher percent lint and lower percent trash, specific equipment trends for the fiber property data were not observed in the AFIS data (Table 2). For example, the neps and SCN were significantly higher for Treatment 9 than for all other treatments except Treatment 2. Treatment 9 had only extractors, whereas Treatment 2 had only cylinder cleaners with both having two separators in the process stream. If the fiber property trend was similar to fiber recovery, the extractor-only treatments should have significantly different fiber properties than the cylinder-cleaner-only treatments. The AFIS data in Table 2 reveal significant differences in fiber properties analyzed based on treatment. However, because the overall quality of the fibers recovered would not be a desirable addition in a lint bale being used in the manufacture of yarn, the fiber quality differences were not considered to be significant enough to use as a metric in selecting one treatment above another.

Figures 1 through 4 show percentages of the total CGB processed that was discarded from each piece of equipment used in that treatment. The percentages are for the treatments with the highest and lowest fractionated lint (i.e., clean fiber) recovered (Table 1). The treatments with the highest percent of fractionated lint in the End Catch were 9 and 3; the lowest two were 5 and 6. Treatments 9 and 3 had extractors as part of their configuration whereas Treatments 5 and 6 had only cylinder cleaners. In Figures 1 and 2, the initial separators removed approximately 10% of the initial mass with the first stage extractor removing a little over 60%. The second stage, in Figures 1 and 2, removed approximately 7% more material. The addition of the second separator in Treatment 9 accounted for an additional 2% more matter being removed, which consisted of material that would be classified as "fines" (i.e., dirt, soil, and small particles of organic matter). Overall, the End Catch of Treatments 9 and 3 (Table 1) were similar with the difference being attributed to the second separator in Treatment 9. The cylinder cleaner removed more than 50% of the initial mass (Figs. 3 and 4). The differences in material removed in the second stage of Figures 3 and 4 are unknown.

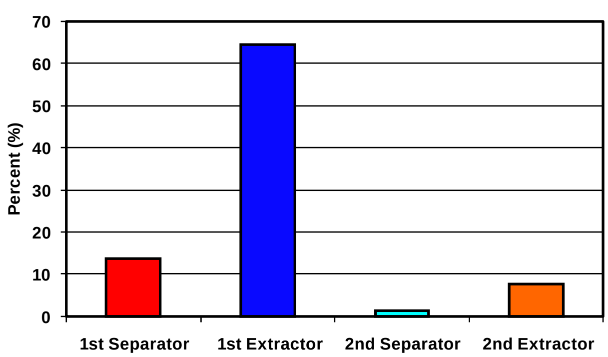

Figure 1. Bar graph of the percent of the initial mass discarded from each piece of equipment used in processing the cotton gin byproducts for Treatment 9.

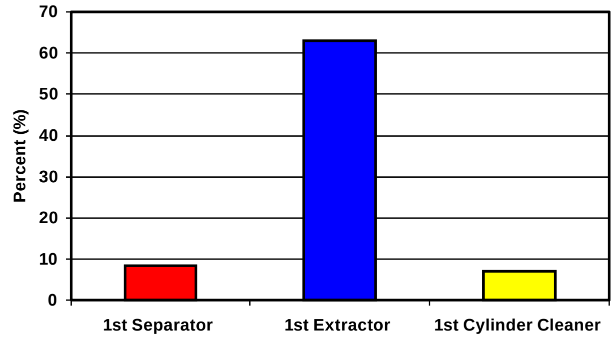

Figure 2. Bar graph of the percent of initial mass discarded from each piece of equipment used in processing the cotton gin byproducts for Treatment 3.

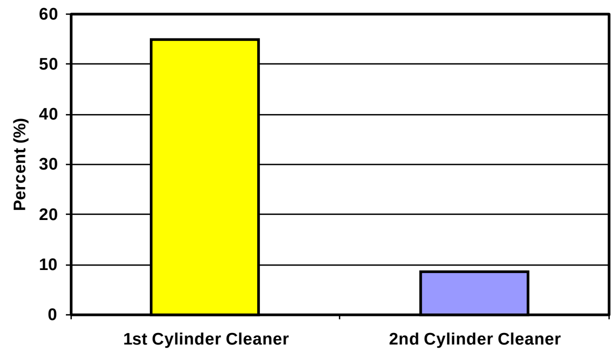

Figure 3. Bar graph of the percent of initial mass discarded from each piece of equipment used in processing the cotton gin byproducts for Treatment 5.

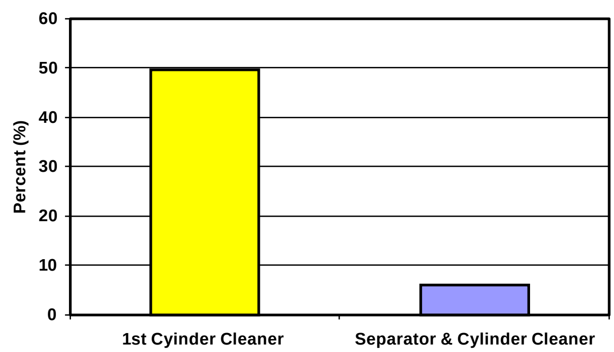

Figure 4. Bar graph of the percent of initial mass discarded from each piece of equipment used in processing the cotton gin byproducts for Treatment 6.

The lint recovered from one- and two-passes through the Shirley analyzer, respectively are shown in Figures 5 and 6. Treatments 3 and 9 had significantly more lint recovered than all the other treatments after one pass through the Shirley (Fig. 5). After two passes (Fig. 6), Treatments 3, 4, and 9 had significantly higher lint turnout than all other treatments. Treatment 6 had the lowest average lint recovery for all treatments. After one- and two-passes, Treatments 1, 2, 5, and 6 had fiber recovery rates less than 10% and 5%, respectively, and were not statistically different. The differences between the Shirley data (Figs. 5 and 6) and the fractionation data (Table 1) are due to the analytical procedures. The Shirley will take out fine particles of foreign matter that would not have been extracted during the fractionation procedure. Both analytical procedures provide useful information but the fractionation data are more representative of what a cotton gin might experience. The Shirley analysis was performed primarily to clean the reclaimed fibers for AFIS analysis.

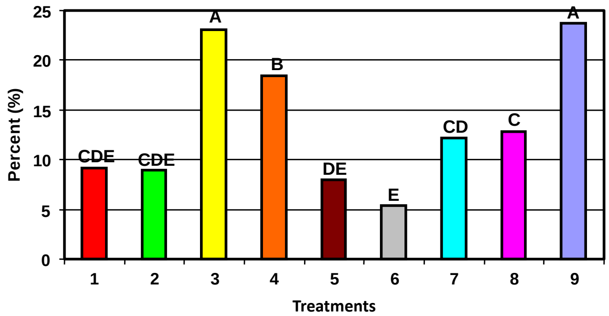

Figure 5. Bar graph of the percent lint recovered from Shirley analysis of the reclaimed fiber obtained from each treatment evaluated in this study after one pass through the Shirley analyzer. Bars with differing letters are significantly different at the 95% confidence interval.

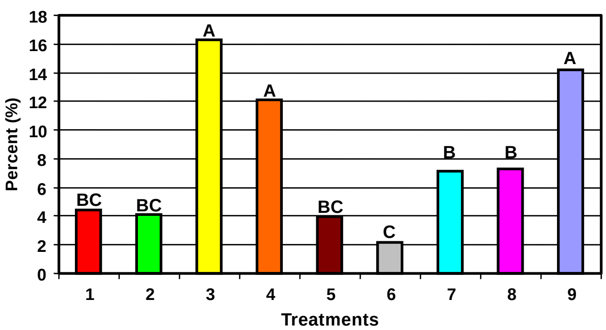

Figure 6. Bar graph of the percent lint recovered from Shirley analysis of the reclaimed fiber obtained from each treatment evaluated in this study after two passes through the Shirley analyzer. Bars with differing letters are significantly different at the 95% confidence interval.

Economic Analysis. The results of the analysis, contained in Table 3, denote an economy of scale. The 20,000 bale/ yr gin would have to realize a fiber recovery increase greater than 11% if recovered fiber prices were $0.11/kg ($0.05/lb). The revenue increase achieved by the other ginning capacities is positive even at the lowest price being analyzed. The trend for the 20,000 bale gins continues with recovered fiber being $0.154/kg ($0.07/lb). Once the recovery rate is above 7% the additional revenue becomes positive. It is not until recovered fiber reaches $0.198/kg ($0.09/lb) that the 20,000 bale gins will have positive revenue at the lowest recovery rate of 5%.

A 5-yr IRR with a MARR of 10% was calculated based on $0.154/kg ($0.07/lb) fiber recovery price using a 9% additional fiber recovery rate. The results of this analysis are shown in Figure 7. With fiber at $0.154/kg ($0.07/lb) at 9% recovery it would not be economically feasible for the 20,000 production gins to recover the fiber with the capital investment greater than $90,000. The 20,000 bale/yr gins are sensitive to the quantity and price of additional fiber recovered. This would suggest a higher degree of risk associated with a volatile recovered fiber market for low capacity gins.

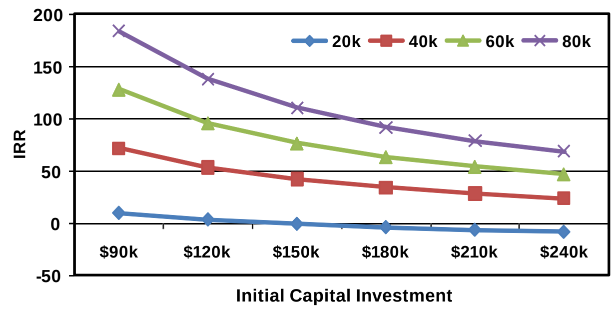

Figure 7. Internal rate of return (IRR) when selling the reclaimed fiber at a mote price of $0.154/kg ($0.07/lb) for a 9%, by weight, fiber recovery rate using capital investments ranging from $90,000 to $240,000 at ginning capacities of 20,000 to 80,000 bales/yr.

Utilizing the $0.154/kg ($0.07/lb) recovered fiber price with a 9% additional fiber recovery the payback period was calculated (Table 4). Once again it can be seen that the 20,000 bale gins will need a higher recovery rate and/or higher fiber price to justify the investment. At the highest investment estimated ($240,000), the 40, 60, and 80,000 bale/yr gins should be able to more than justify the investment.

In economic terms, with a $0.154/kg ($0.07/lb) value placed on recovered fiber, the financial value of each Mg of fiber would be $154.00. The value of CGB could be negative if the gin had to pay to have the material hauled away and the cost of disposing of the CGB was greater than the cost gained from sale of the CGB or the fibers recovered from it. However, even if a gin had to pay for disposal of the CGB, by reclaiming the fibers contained in the CGB they would reduce the amount of material needing to be hauled away and thus reduce the cost of disposal. Holt (2010) called several cotton gins in West Texas and discovered that gins were generally experiencing an income of between $5.50 to $16.50 per Mg ($5.00 to $15.00 per ton) for their CGB. Revenue from CGB is possible if a regional market exists for the raw material or its constituents (i.e., reclaimed fibers).

Table 3. Additional revenue ($) potential generated by fiber recovery rates of 5 to 15% for ginning capacities ranging from 20,000 to 80,000 bales of cotton at motes prices of $0.11/kg to $0.33/kg ($0.05/lb to $0.15/lb).

Price	Gin Capacity	Fiber Recovery % Related to Additional Revenue					
		5%	7%	9%	11%	13%	15%
$0.11/kg ($0.05/lb)	20K	$(15,884)	$(7,884)	$116	$8,116	$16,116	$24,116
	40K	4,116	20,116	36,116	52,116	68,116	84,116
	60K	24,116	48,116	72,116	96,116	120,116	144,116
	80K	44,116	76,116	108,116	140,116	172,116	204,116
$0.154/kg ($0.07lb)	20K	(7,884)	3,316	14,516	25,716	36,916	48,116
	40K	20,116	42,516	64,916	87,316	109,716	132,116
	60K	48,116	81,716	115,316	148,916	182,516	216,116
	80K	76,116	120,916	165,716	210,516	255,316	300,116
$0.198/kg ($0.09/lb)	20K	116	14,516	28,916	43,316	57,716	72,116
	40K	36,116	64,916	93,716	122,516	151,316	180,116
	60K	72,116	115,316	158,516	201,716	244,916	288,116
	80K	108,116	165,716	223,316	280,916	338,516	396,116
$0.242/kg ($0.11/lb)	20K	8,116	25,716	43,316	60,916	78,516	96,116
	40K	52,116	87,316	122,516	157,716	192,916	228,116
	60K	96,116	148,916	201,716	254,516	307,316	360,116
	80K	140,116	210,516	280,916	351,316	421,716	492,116
$0.286/kg ($0.13/lb)	20K	16,116	36,916	57,716	78,516	99,316	120,116
	40K	68,116	109,716	151,316	192,916	234,516	276,116
	60K	120,116	182,516	244,916	307,316	369,716	432,116
	80K	172,116	255,316	338,516	421,716	504,916	588,116
$0.33/kg ($0.15/lb)	20K	24,116	48,116	72,116	96,116	120,116	144,116
	40K	84,116	132,116	180,116	228,116	276,116	324,116
	60K	144,116	216,116	288,116	360,116	432,116	504,116
	80K	204,116	300,116	396,116	492,116	588,116	684,116

Table 4. Payback period (yr) based on capital expenditures ranging from $90,000 to $240,000 if the reclaimed fiber was sold at a mote price of $0.032/kg ($0.07/lb) using a 9% fiber recovery rate.

Price	Gin Capacity	Payback Period (yrs)					
		$90,000	$120,000	$150,000	$180,000	$210,000	$240,000
$0.154/kg ($0.07/lb)	20K	6.20	8.27	10.33	n/a	n/a	n/a
	40K	1.39	1.85	2.31	2.77	3.23	3.70
	60K	0.78	1.04	1.30	1.56	1.82	2.08
	80K	0.54	0.72	0.91	1.09	1.27	1.45

SUMMARY AND CONCLUSIONS

In an effort to address the question "What is the best equipment sequence to recover the largest amount of marketable fiber from CGB (gin waste)?" a study was conducted evaluating select combinations of separators, cylinder cleaners, and extractors. In this study, nine treatments were evaluated based upon the quantity of clean marketable fiber that could be recovered from stripper-harvested CGB/gin waste collected from a commercial gin in West Texas. The cotton gin where the byproducts were obtained bale their lint cleaner waste. Thus, the amount of recoverable fiber obtained from the CGB used in this study was from lint and/or seedcotton discarded from the receiving and precleaning equipment with minute amounts from the mote press cleaning system. The clean marketable fibers were those that were deemed suitable for inclusion into the gin mote bales. Results showed that equipment streams using cylinder cleaners only did not produce as clean of a marketable fiber compared to machinery sequences that included extractors. The sequence that produced the cleanest marketable fibers was Treatment 9, which consisted of a separator, extractor, separator, and extractor. AFIS data obtained from the lint collected from each treatment indicated statistically significant differences for some of the parameters measured. However, because the AFIS quality characteristics of the fibers recovered were lower than the quality desired by textile mills in the manufacture of yarns (i.e., short fiber contents ranging from 23 to 30% by weight and 53 to 63% by number), the AFIS data were not used in selecting one treatment over another even though statistically significant differences existed.

An economic analysis of selling the recovered fiber at mote prices ranging from $0.11/kg to $0.33/kg ($0.05/lb and $0.15/lb) for cotton gins producing 20,000 to 80,000 bales/yr at fiber recovery rates of 5 to 15% revealed high internal rates of return for gins with annual productions of 40,000 bales or more with capital investments of $90,000 to $240,000. For gins with 20,000 bales/yr, recovery rates of 9% plus mote prices equal to or greater than $0.198/kg ($0.09/lb) were required to achieve positive cash flows based on the assumptions used in the analysis.

DISCLAIMER

Mention of product or trade names does not constitute an endorsement by the USDA-ARS over other comparable products. Products or trade names are listed for reference only.

ACKNOWLEDGMENTS

The partial support of this research by Cotton Incorporated is gratefully acknowledged.

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