

Effect of Cotton Preparation on Grade and International Marketability

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Abstract

This study is concerned with enhancement of the quality and grade of Sudanese cottons and hence improving their marketability in international markets. Field experiments were conducted in the Gezira Scheme for two consecutive seasons 2000-01 and 2001-02 to estimate the effects of scheduled (improved) cotton picking and seed cotton cleaning in the field. The variety Barac(67)B was investigated in Barakat Block while the variety Barakat-90 was the subject of the study in Umdagarsi Block. The results showed a positive trend by applying the scheduled cotton picking and seed cotton cleaning, amounting to the improvement of cotton quality by a full grade. Furthermore, the cotton homogeneity was improved as shown by the reduced variability in fibre properties. As a result, a gain of about 21.185 million dollars could be realized, a matter which is of a remarkable benefit to the national economy.

Introduction

Cotton remains the most important fibre accounting for about 48% of the main textile fibres in use throughout the world. As a natural Product, cotton is subjected to the uncertainties inherent in agricultural production. Cotton fibres contain various impurities, leaf trashes, plant remains, foreign matter and insect honeydew contamination. In the Sudan, cotton importance stems from the fact that it has several uses, however, the crop is mainly produced for fibre exportation and local textile industry.

For decades all kinds of foreign matter found inside cotton bales were often eliminated by hand as long as spinning was still largely a labour-intensive technology. The extensive steps which previously required the intervention of manual labour are increasingly performed by machines. The biggest problem facing automation process is attributed to cotton contamination and cleanliness. Automated equipments are incapable of detecting cotton contamination or foreign matter. For instance, plastic material damage is becoming visible only by the time the fabric leaves the final finishing process. Honeydew contamination, which has now become a major problem, is not only affecting quality and appearance of the product, but also causes fibre adherence to the machine, reducing production and in severe cases the production is brought to stand still or stop.

This new technology is, however, putting increased pressure on cotton industry to deliver fibres with increasing specific characteristics and cleanliness. Khalifa and Gameel (1982) stated that the problem of cotton stickiness is becoming a limiting factor in cotton production and currently considered as the most serious quality factor

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confronting the textile industry. Similarly Perkins (1983) indicated that most quality deficiency is the fibre stickiness which causes significant production and quality losses in textile industry each year. Although, the exact economic losses due to honeydew contamination on cotton have not been rigorously established, Khalifa and Gameel (1982) reported a gin out-put of 10-15 lbs. of lint per hour for sticky cotton compared to the normal output of 50-60 lbs for clean seedcotton. However, they reported an economic loss of 5 – 10% lint per pound. Carlson and Mohamed (1986) reported high cost due frequent blade replacement and reduced output of ginning sticky cotton under high relative humidity.

The price difference between sticky and non-sticky cotton could reach about 10% as stated by the Sudan cotton company. Moreover, Kahalifa (1980) reported a loss of 15 million dollars every crop season resulting from the price differential on sticky cotton in Sudan. Fadlalla (1998) noted that the whole country produce continued, over the years, to be stamped with stickiness whether it was really contaminated or not and priced less than equivalents produced else where.

Owing to either ignorance and/or lack of proper care both fibre contamination and characteristics are becoming affected, resulting in heavy penalties paid by producers in form of low prices. Agronomists, breeders and entomologists proposed various technical solutions and advices to growers to reduce honeydew contamination in the field. The use of these techniques alone or in combination might partially reduce stickiness contamination in the field. However, none of the above technical solutions and advices had fully solved the problem. Therefore, new technical solutions need to be studied.

The objective of this study was to reduce the foreign matter content and the honeydew contamination of the seed cotton in order to improve the grade value and preserve the inherent quality following scheduled hand picking and manual seed cotton cleaning in the field.

Materials and Methods

This study was carried out at the Gezira scheme for two successive seasons (2000-01 and 2001-02). Two cotton varieties were used, Barac(67)B cotton variety grown at Barakat Block in the farm field of tenant No. 3. Barakat-90 cotton variety grown at Aumdagrasi in the farm field of tenant No. 270. The two adjacent farmer fields were used as control . Each of the main folios was picked in three scheduled picks, at two weeks intervals, and the seedcotton of each pick was manually cleaned and pressed in sacks. While the control folios were picked in one conventional pick.

The seed cotton was classed at Maringan and Hassahisa ginning yards. Samples representing the picked cotton were chosen randomly and tested for fibre properties and honeydew contamination at the cotton Fibre, Spinning and Stickiness Research Laboratory, Wad Medani, according to standards and under controlled atmosphere of $20\text{C}^{\circ}\pm 1$ temperature and $65\pm 2\%$ relative humidity (R.H%). The Fibrograph, port- Ar, Stelometer, H.V.I and Sticky cotton thermodetector (S.C.T) instruments were used.

The data obtained were subjected to statistical analysis according to Ratnam and Seshan (1987) as a reference to significance as listed Table 1. The extent of variation presents between the two samples was computed as follows:-

1- Difference in the character between the two samples $N = A-B$

2- Average of the two values $\chi = \frac{A+B}{2}$

3- Difference expressed as a percentage average (The actual difference y)

$$y = \frac{N \times 100}{\chi}$$

Where: A= Basic sample, B = Delivery sample, N = Difference between the tow samples, Y = Difference expressed as percentage of the average. If the actual difference is greater than the CD listed value in the Table 1, the difference will be critical.

Results and Discussion

Tables 2, 3, 4 and 5 show clearly that cotton grades of Barac (67)B were improved by the scheduled picking and manual cleaning in the field. They gave satisfactory improvement in grade, reaching 72% grade one and 25% grade two in the first pick compared to farmer practice (bulk picking) that gave 39% grade one and 50% grade two. Results in Tables 6, 7, 8 and 9 indicated that scheduled picking and manual cleaning of Barakat -90 resulted in high grades, reaching 16.7% grade one and 36.6% grade two, compared to farmers practice in the neighbouring field that gave zero% grade one and 14.5% grade two. Those low grades could be attributed to the long time exposure of open bolls to weather and honeydew contamination. Analysis of fibre quality carried out on the samples of Barac(67)B at Barakat block in season 2000-01 and 2001-02 show that the samples of pick one had a mean fibre length of 28.3 mm ranging between 28.02 and 28.32 mm (Table 10). Table 11 shows that the mean fibre bundle strength of pick one was 23.13 g/tex ranging between 23.10 to 23.16 g/tex. The mean value of the micronaire was 4.33 ranging between 4.2 to 4.5 (Table 12). However, different results of fibre characteristics for the same variety were recorded from the farmer practice. For instance, the mean fibre length of Barac(67)B cotton variety was 27.9 mm with minimum value of 25.7 mm. The mean fibre bundle strength was 20.67 g/tex with minimum value of 19.1 g/tex and the mean micronaire value was 4.0, ranging between 3.6 to 4.3. These differences in fibre characteristics for the scheduled picking and manual cleaning and the farmer practice are probably due to the effect of adverse environmental conditions on the opening bolls that remained unpicked for a long time.

When scheduled picking and manual cleaning were practiced on Barakat-90, the mean fibre length was 34.7 mm compared to farmer practice. Mean fibre strength was 30.1 g/tex compared to farmer practice and the mean micronaire value was 4.10 compared to farmer practice (Tables 13, 14 and 15). With regard to trash content, the mean values of the samples of Barac(67)B scheduled picking and manually cleaned (Table 16) is 0.32%, ranging between 0.30 and 0.5% compared to 1.14% for the farmer practice. Scheduled picking resulted in low trash content for Barakat-90 (0.38%) ranged between 0.2% and 0.5% compared to 3.96% resulted from the farmer practice ranging between 0.7% and 5.0% (Table 17).

Table 18 shows that the mean number of the sticky points in Barac (67)B samples was 3.9 which was lower than the mean number recorded from farmer practice (38 points). Table 19 shows that the samples of Barakat-90 variety gave a mean number of 2.4 sticky points in pick one, 1.6 points in pick two and 0.9 points in pick three, while the farmer practice gave a mean number of 20 sticky points ranging between 9 and 33 points. However, Barakat-90 was less contaminated with honey dew than

Barac(67)B. This might be attributed to the fact that Barakat-90 bolls opens late in the season and escape the white fly peak infestation.

With regard to the economic evaluation of the scheduled picking and manual cleaning, Tables 20, 21, 22 and 23 show that the expected difference in returns between scheduled picking and farmer practice for Barac(67)B cotton variety could reach 1.46 million dollars in season 2000-01 and 0.15 million dollars in season 2001-02. Tables 24, 25, 26 and 27 show that the estimated difference in Barakat-90 cotton variety between the scheduled and the farmer practice could reach 2.42 million dollars in season 2000-01 and 8.11 million dollars in season 2001-02. The noticeable increased acreage devoted to Barakat-90 is due to the fact that this variety fetches higher prices in cotton markets.

The results in Table 27 show a positive trend after process modifications which could result in a gain of about 14.95 million dollars in season 2001-02 a matter of a remarkable benefit to the national economy, provided that the results obtained could be applied in the Gezira scheme .

Recommendations

Based on the results of this study, the following recommendations are suggested:

1. Scheduled picking and manual cleaning in the field should be adopted in harvesting medium, long and extra long staple cotton varieties.
2. Each pick of seed cotton should be cleaned, pooled and pressed separately.
3. Cotton collection stations should be kept clean and cotton handled with care and transported to the ginning yards first in first out.
4. The differential price for higher grades must be sufficient to reward the farmer for his efforts in sorting and segregating the higher grades from the lower grades of seed cotton.

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Table 1. Number of tests and critical Difference (%) for various fibre properties.

Fibre Property	No. of tests	Critical difference (% of mean)
2.5% span length	4 comb/sample	4
Uniformity ratio	4 comb/sample	5
Micronaire value	4 comb/sample	6
Fibre strength 3 mm gauge length	10 comb /sample	5
Maturity coefficient	100 fibres/sample	7
Trash content	8 test/sample	7

Source: The South India Textile Research Association Coimbatore (S.T.R.A)

Table 2. Seed cotton yield in Kantar (K) and grade of Barac (67)B variety conventional picking, Season 1999-00.

Farmer Number	Yield (K) Per 5 Fed	Seed Cotton Grade					
		One	Two	Three	Four	Five	Six
3	32.9						
	Grade %	-	81.2%	16.0%	3.0%	-	-
4	11.3						
	Grade %	20%	53%	27%	-	-	-
387	22.6						
	Grade %	48%	37%	9%	6%	-	-

Table 3. Seed cotton yield (K) and grade of scheduled picking of Barac (67)B variety of farmer Babo, season 2000-01.

Farmer Number	Yield (K) Per 5 Fed	Seed Cotton Grade					
		One	Two	Three	Four	Five	Six
3	46.4						
	Grade %	65%	21%	13%	2%	-	-
4	25.4						
	Grade %	32%	57%	8%	3%	-	-
287	24.3						
	Grade %	51%	39%	9%	-	-	-

Table 4. Seed cotton yield (K) and grade of scheduled picking of Barac (67)B of farmer Babo, season 2001-02.

Farmer Number	Yield (K) Per 5 Fed	Seed Cotton Grade					
		One	Two	Three	Four	Five	Six
3	45.2						
	Grade %	72%	25%	2%	-	-	-
4	25.2						
	Grade %	39%	50%	12%	-	-	-
387	28.4						
	Grade %	52%	31%	9%	9%	-	-

Table 5. Comparison between seed cotton grade of farm number (3) of farmer (Babo Haron), season 1999-00).

Season	Yield (K) Per 5 Fed	Seed Cotton Grade					
		One	Two	Three	Four	Five	Six
First	26.4	-	81.6	15.6	2.8	-	-
Second	37.3	64.9	20.6	12.9	2.8	-	-
Third	36.3	71.6	25.4	3.0	-	-	-

Table 6. Seed cotton yield (K) and grade of Barakat-90, conventional picking, season 1999-00.

Farmer Number	Yield (K) Per 5 Fed	Seed Cotton Grade					
		One	Two	Three	Four	Five	Six
270	23.6				3.8%		
	Grade %	-	4.2%	71.2%		20.8%	-
269	21.2						
	Grade %	-	13.9%	24.3%	47.6%	9.5%	4.7%
271	26.2		7.2%	66.7%			
	Grade %	-			-	-	-

Table 7. Cotton yield (K) and grade of scheduled picking of Barakat- 90 of farmer Elfadil, season 2000-01.

Farmer Number	Yield (K) Per 5 Fed	Seed Cotton Grade					
		One	Two	Three	Four	Five	Six
270	24.1		14.5%				
	Grade %	9.1%		41.3%	26.4%	8.7%	
269	18.4			17.9%			-
	Grade %	-	34.4%		30.2%	17.5%	
271	23.1	-					-
	Grade %		13.9%	41.8%	35.6%	8.7%	

Table 8. Cotton yield (K) and grade of scheduled picking of Barakat-90 of farmer Elfadil, season 2001-02.

Farmer Number	Yield (K) Per 5 Fed	Seed Cotton Grade					
		One	Two	Three	Four	Five	Six
270	25.2					-	
	Grade %	16.7%	16.9%	36.5%	29.9%		-
269	24.8						
	Grade %	-	14.5%	45.1%	25%	11.7%	3.7%
271	23.2						
	Grade %	-	12.2%	22.4%	52.3%	9.3%	3.8%

Table 9. Comparison between seed cotton grade of farm number 270 of farmer Elfadil, season 1999-00.

Season	Yield (K) Per 5 Fed	Seed Cotton Grade					
		One	Two	Three	Four	Five	Six
First	33.3	-	4.2	72.2	3.8	20.8	-
second	26.7	9.1	14.5	41.3	26.4	8.7	-
third	34.2	16.7	16.9	36.5	29.9	-	-

Table 10. The average staple length (mm) of variety Barac(67)B, season 2000/01 and 2001-02.

Pick	First season	Second season	Range	Mean	C.V%
One	28.02	28.32	28.5 -27.9	28.2	0.22
Two	27.97	28.02	28.2 -27.8	28.0	0.24
Three	27.70	27.78	28.0 -27.6	27.7	0.25
Control	27.78	27.92	28.3 -25.7	27.9	0.82

Table 11. The average bundle strength(g/tex) of Barac(67)B cotton variety in season 2000-01 and 2001-02.

Pick	First season	Second season	Range	Mean	C.V(%)
One	23.10	23.16	23.4 - 23.0	23.13	0.42
Two	22.92	22.88	23.0 – 22.7	22.90	0.50
Three	21.51	21.22	22.4 – 19.9	21.36	0.57
Control	20.50	20.85	22.7-19.1	20.67	1.454

Table 12. The average micronaire value of Barac(67)B cotton variety in season 2000-01 and 2001-02.

Pick	First Season	Second season	Range	Mean	C.V(%)
One	4.38	4.28	4.5 – 4.2	4.33	0.08
Two	4.18	4.18	4.4 - 4.1	4.18	0.11
Three	3.92	3.78	4.2 - 3.8	3.85	0.13
Control	4.08	4.02	4.3 - 3.6	4.05	1.39

Table 13. The average of staple length(mm) of Barakt-90 cotton variety in season 2000-01 and 2001-02.

Pick	First Season	Second season	Range	Mean	C.V(%)
One	34.5	34.8	35.2 – 34.4	34.7	0.64
Two	34.4	34.6	35.0 – 34.0	34.5	0.66
Three	33.1	33.6	33.9 – 33.1	33.4	1.02
Control	33.9	34.0	35.1 – 32.1	33.9	2.11

Table 14. The average of Bundle strength(g/tex) of Barakat-90 cotton variety in season 2000-01 and 2001-02.

Pick	First Season	Second season	Range	Mean	C.V(%)
One	30.1	30.3	30.8 – 29.6	30.1	1.39
Two	29.4	30.1	30.8 – 29.1	29.8	1.60
Three	28.1	29.5	30.5 – 27.6	28.8	1.64
Control					

Table 15. The average Micronaire Value of Barac(67)B cotton variety in season 2000-01 and 2001-02.

Pick	First Season	Second season	Range	Mean	C.V(%)
One	4.8	4.12	4.0-4.2	4.10	2.03
Two	4.06	4.08	3.9-4.2	4.07	2.05
Three	3.82	3.90	3.7-4.1	3.95	2.05
Control	3.88	4.02	3.5-4.1	3.95	7.06

Table 16. The average trash content of Barac(67)B cotton variety in season 2000-01 and 2001-02.

Pick	First season	Second season	Range	Mean	C.V(%)
One	0.33	0.32	0.50 – 0.30	0.32	0.08
Two	0.78	0.86	0.80 – 0.50	0.82	0.17
Three	1.95	1.08	1.10 – 0.90	1.51	0.15
Control	4.52	4.30	4.2 – 3.8	1.41	3.07

Table 17. The trash content of Barakat-90 cotton variety in season 2000-01 and 2001-02.

Pick	First season	Second season	Range	Mean	C.V(%)
One	0.36	0.40	0.5 – 0.2	0.38	0.11
Two	0.60	0.70	1.0 – 0.6	0.65	0.16
Three	1.00	1.04	1.3 – 0.7	1.02	0.27
Control	4.00	3.92	5.0 – 0.7	3.96	1.03

Table 18. The average sticky point number of Barac(67)B cotton variety in season 2000-01 and 2001-02.

Pick	First Season	Second season	Range	Mean	C.V(%)
One	3.6	4.0	7 - 2	3.8	1.58
Two	2.6	2.8	4 - 1	2.7	1.03
Three	2.0	2.6	5 - 1	2.3	0.83
Control	22.0	41.6	70 - 20	38	10.03

Table 19. The average sticky point number of Barakat-90 cotton variety in season 2000-01 and 2001-02.

Pick	First Season	Second season	Range	Mean	C.V(%)
One	2.0	2.8	4 – 0	2.4	1.40
Two	1.2	2.0	4 – 0	1.6	1.58
Three	0.8	1.0	2 – 0	0.9	0.83
Control	20.6	19	33 - 9	20	8.36

Table 20. The total yield and returns of Barac (67)B cotton crop in Gezira in season 2000-01.

Grade	Weight kantar	Percent	Price cent/Lb	Value(in million USD)
1	44850	29.5	35.81	1.61
2	95936	63.1	33.01	3.17
3	7379	0 4.7	32.95	2.43
4	3814	0 2.5	34.31	0.13
Total	151979	100		5.15

Table 21. The total yield and return expected from Barac(67)B cotton crop grown in Gezira in season 2000-01.

Grade	Weight kantar	Percent	Price cent/Lb	Expected value in million USD
1	347771	64.6	35.71	12.45
2	110899	20.6	33.01	3.66
3	68908	12.8	32.95	2.27
4	10767	2.0	29.10	0.37
Total	538347	100	–	18.75

Table 22. The total yield and return expected from Barac(67)B cotton crop grown in Gezira in season 2001-02.

Grade	Weight kantar	Percent	Price cent/Lb	Expected value in million USD
1	44850	29.5	35.81	1.61
2	95936	63.1	33.01	3.17
3	7379	0 4.7	32.95	2.43
4	3814	0 2.5	34.31	0.13
Total	151979	100		5.15

Table 23. The total yield and return expected from Barac (67) B cotton crop grown in Gezira in season 2001-02.

Grade	Weight Kantar	Percent	Price cent/Lb	Expected value in million USD
1	108817	71.6	35.81	3.90
2	38603	25.4	33.01	1.27
3	4559	3.0	32.95	0.15
4	-	-	-	-
Total	151979	100		5.32

Table 24. The total yield and return expected from Barakat-90 cotton crop grown in Gezira in season 2000-01.

Grade	Weight kantar	Percent	Price cent/Lb	Value in million USD
B	00 2730	0.50	84.58	0.32
x2	00 3003	0.54	81.90	0.24
2	0 33208	6.03	75.16	2.50
x3	0 59518	10.81	75.82	4.51
3	0 70707	12.84	75.72	5.37
x4	0 57330	10.41	71.79	4.11
4	258465	45.93	62.89	16.29
x5	0 36157	6.57	60.71	2.20
5	0 25042	4.55	60.24	1.51
x6	00 5140	0.93	57.00	0.29
6	00 4785	0.87	55.00	0.26
c 6	000 253	0.05	53.00	0.01
D 6	000 117	0.02	50.00	0.01
Total	556456	100.00		37.53

Table 25. The total yield and return expected from Barakat-90 cotton crop grown in Gezira in season 2001-02.

Grade	Weight kantar	Percent	Price cent/Lb	Expected value in million USD
B	50637	09.1	84.58	4.28
x2				
2	80686	14.5	75.16	6.06
x3				
3	229816	41.3	75.92	17.45
x4				
4	146904	26.4	62.89	9.24
x5				
5	48411	8.7	60.27	2.92
Total	556456	100		39.95

Table 26. The Total yield and return expected from Barakat-90 cotton crop grown in Gezira in season 2001-02.

Grade	Weight kantar	Percent	Price cent/Lb	Value in million USD
x2	1879	0.19	65.69	0.12
2	42629	4.39	63.38	0.27
x3	103840	10.70	61.88	6.43
3	152417	15.71	61.00	9.30
x4	134863	13.90	57.99	7.82
4	143607	14.81	54.79	7.86
x5	120417	12.41	50.38	6.07
5	96949	9.99	50.08	4.93
x6	68007	7.01	48.05	3.27
6	72423	7.47	46.98	3.40
C6	31831	3.28	44.00	1.40
D6	1204	0.12	42.00	0.05
Total	970065	100		50.92

Table 27. The total yield and return expected from Barakat-90 cotton crop grown in Gezira in season 2001-02.

Grade	Weight kantar	Percent	Price cent/Lb	Expected value in million USD
B	162001	16.7	68.89	11.60
x2			65.69	
2	163941	16.9	63.38	10.39
x3			61.88	
3	354074	36.5	61.00	21.6
x4			57.99	
4	290049	29.9	54.76	15.88
x5			50.38	
5	-	-	50.08	-
Total	970065	100		59.03

Table 28. The expected benefits From conducting the scheduled cotton picking and manual cleaning in the Gezira 2000-02.

Description	Season 2000-2001		Season 2001/2002	
	Million USD	Million USD	Million USD	Million USD
A-Quality improvement:				
1-Barac (67)B	1.46		0.15	
2-Barakat-90	2.42		8.11	
Sub total	3.88	3.88	8.26	8.26
B-Reducing stickiness:				
1-Barac(67)B	2.60		0.77	
2-Barakat-90	5.62		7.64	
Sub total	8.22	8.22	8.41	8.41
Reducing trash content:-				
1-Barac (67)B	1.24		1.75	
2-Barakat -90	1.28		2.24	
Sub total	2.52	2.52	4.09	4.09
D-300 bales per lot:	Number of Bales	Number of lots	Number of Bales	Number Lots
1-Barac(67)B	092681	309	46054	154
2-Barakat-90	164380	548	285313	951
Sub-total		857	0.33	1105
Grand total			14.950	21.180