Geziraj. of eng. & applied . sci. 4 (2) :20 —34 (2009)

# Impact of Cotton Preparation on Grade and Price

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## ABSTRACT

This study is concerned with enhancement of the quality and grade of Sudanese cottons in order to improve their marketability in international markets. Field experiments were conducted during 2()()0 2002 at Gezira Scheme, Sudan on Barac (67)B variety in Baracat Block , while the variety Barakat-90 was the subject of the study in Umdagatsi Block. The objectives of this study were to improve cotton fibre quality, grade and to reduce honey due contamination in the commercial cotton cultivars; and Barac(67)B Results indicated that scheduled cotton picking and seed cotton cleaning improved cotton quality by a full grade. Also, cotton homogeneity was improved ensuing lower fiber properties variability and reduced stickiness contamination. The results of this study ascertained that on amount of 21.2 million dollars could be secured to the national income and Sudan's cotton position in the international marked is strengthened, provided that recommendation of this study, are applied.

## INTRODUCTION

Cotton is the most important textile fibre accounting for about 48% of all textile fibres in use. As a natural product, cotton is subjected to the uncertainties inherent in agricultural production. Cotton fibres contains various impurities, such as; leaf trashes, plant remains, foreign matter and insect honeydew contamination. In Sudan the importance of cotton stems from the fact that it has several uses, however, the crop is mainly produced for international and local textile industries.

For decades all kinds of foreign matter found inside cotton bales were often removed by hand as long as spinning was still largely a labour intensive processing technology. In modern technology most of the processes which were performed manually are now fully automation. Main automated equipments are incapable of detecting cotton contamination or foreign matter. For instance, plastic material damage is becoming visible only at 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 affects the machine performance in that fibers stick to machine parts resulting in

lower production rates and in severe cases the production is brought to stand still or stop. ITMF (2003).

This new technology, however, is putting increased pressure on cotton producers 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 is considered as the most serious quality factor confronting the textile industry. Perkins (1983) indicated that the biggest quality deficiency in textile industry is the fibre stickiness which causes significant losses in production and quality each year. Although, the exact cash losses due to honeydew contamination on cotton have not been rigorously established, Khalifa and Gameel (1982) found that the ginning out-put was (10-15) Lbs. of lint per hour for sticky cotton compared to (50-60) Lbs. for stickiness free cotton. However, they reported an economic loss of (5- 10) % lint per pound. Carslon and Mohamed (1986) reported an increase in production cost due to the frequent blade replacement and decrease in the out put when ginning sticky cotton at high relative humidity on lint.

The difference in price between sticky and non -sticky cotton could reach about 10% as stated by the Sudan cotton company. More over, Kahalifa (1980) quoted 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 production for years, to be stamped with stickiness whether it was really contaminated or not and there for, priced less than equivalents varieties produced else where.

In Sudan, hand picking gives the best results in terms of fully matured fibres, clean from dirt, seed coat and trash. Owing to either incorrect practice and or lack of proper care both fibre contamination and characteristics are becoming affected, resulting in penalties paid by producers. 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 with other techniques might partially reduce stickiness contamination in the field However, none of these technical solutions and advices had fully solved the problem. Therefore, new technical solutions have been studied-

The aim of this work was to Study in more depth the possible ways and means 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

## MATERIAL 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 grown at Barakat Block in the farm field of tenant No. 3.and Barakat-90 variety grown at Umdagrsi in the farm field of tenant No, 270. The two adjacent fields to the two fields of the two tenants were used as control . Each of the main folios was picked under three scheduled picks, in two weeks intervals, and the seed cotton of each pick was manually cleaned and packed 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, under standard atmosphere.

Conditions of (200±1) temperature and (65±2%) relative humidity.

The Fibrograph, port- Ar, Stelometer, H. V .1 and Sticky cotton thermodetector (S.C T) instruments were used to determine the fibre properties. The data obtained was statistically Analysed according to T. V. Ratnam and K.N.Seshan (1987) as a reference to significance as shown in

table (l) . The extent of variation between the two samples was computed as follows:-

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

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

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

$$y = \frac{N\,x100}{x}$$

Where:-

A: Basic sample

B: Delivere of sample

d sample

N: Difference between the two samples

y: Difference expressed as percentage of the average

If the value of the actual difference is greater than that of the critical difference (C.D) shown in Table (l). To the difference will be classified critical.

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 sample | 4 |
| Uniformity ratio | 4 sample | 5 |
| Micronaire value | 4sample | 6 |
| Fibre strength at 3 mm,gauge Lengh | 10 breaks/ sample | 5 |
| Maturity coefficient | 100 fibres/sample | 7 |
| Trash content | 8 test/sample | 7 |

Source: The South India Textile Research Association Coimbatore (STA.A)

## RESULTS and DISSCUSSION

The results are given in table 2 and 3 . From the results it can be seen that the grades were improved when implementing scheduled picking and manual cleaning , reaching 720 0 grade one and 250 0 grade two in the first pick compared to conventional practice (bulk picking) that gave 39% grade one and 50% grade two. The results in Tables4 and 5 indicated that scheduled picking and manual cleaning of Barakat -90 resulted in high grades, reaching 16.7% grade one and 16.9% grade two, compared to farmers practice in the neighbouring field that gave no grade one cotton and gave only 14.5% grade two. This may be attributed to the exposure of open bolls to weather and honeydew contamination for long time Analysis of The fibre quality of Barac(67)B grown at Barakat block in season 2000/01 and 2001/02 show that the samples of the first pick e had a mean fibre length of 28.3 mm. ranging between 28.02 and 28.32 mm. 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 as shown in table (6). 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 27.9mm with minimum value of 25.7. 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 at one hand and the farmer practice at the other are probably due to the effect of adverse environment at conditions on the opening bolls that remained un picked for a long time.

Table (2) Average Seed cotton yield (K) and grade of Barac (67)B conventional and scheduled picks. Seasons 2000/2002

| Farmer Number | Picking | Yield (K) Per 5 Fed | Seed Cotton Grade% | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | I | II | III | IV | V | VI |
| 3 | Conventional<br>scheduled | 32.9<br>45.2 | -<br>72 | 81.0<br>25.0 | 16.0<br>3.0 | 3.0<br>- | -<br>- | -<br>- |
| 4 | Conventional<br>Conventional | 11.3<br>25.2 | 20<br>39 | 53<br>50 | 27<br>11 | -<br>- | -<br>- | -<br>- |
| 387 | Conventional<br>Conventional | 22.6<br>28.6 | 48<br>52 | 37<br>31 | 9<br>9 | 6<br>8 | -<br>- | -<br>- |

K = Kanter -315 lb*
*Grade : Based on color, Leaf, Trash and preparation
lower figure, better grade *

Table (3) Comparison between seed cotton grade of farm number (3) of farmer (Babo Haron) seasons(1999-2002)

| Seasons | Yield (K) Per 5Fed | Seed Cotton Grade% | | | | | |
|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI |
| First Season | 26.4 | - | 81.6 | 15.6 | 2.8 | - | - |
| Second season | 37.3 | 63 | 20.6 | 129 | 2.8 | - | - |
| Third season | 36.3 | 71 6 | 25.4 | 3.0 | - | - | - |

K — Kanter =315 lb*
* Grade : Based on color, Leaf, Trash and preparation
lower figure indicates better grade *

Table(4) Seed cotton yield (K) and grade of Barakat -90 variety conventional picking . season 1999/2000

| Farmer Number | Picking | Yield (K) Per 5 Fed | Seed Cotton Grade% | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | I | II | III | IV | V | VI |
| 270 | Conventional<br>Scheduled | 23.6<br>25.2 | -<br>16.7 | 4.2<br><br>16.9 | 71.2<br>36.5 | 3.8<br><br>29.9 | 20.8<br><br>- | -<br><br>- |
| 269 | Conventional<br>Conventional | 21.2<br>24.8 | -<br>- | 13.9<br><br>14.5 | 24.5<br>45.1 | 47.6<br><br>25.0 | 0.5<br>11.7 | .50<br>3.7 |
| 271 | Conventional<br>Conventional | 26.2<br>23.2 | -<br>- | 7.2<br><br>12.2 | 66.7<br>12.4 | 20.1<br>52.3 | 5.0<br>9.3 | 1.0<br><br>3.8 |

K Kanter =315 1b*
* Grade : Based on color, Leaf, Trash and preparation
lower figure indicates better grade *

Table (5) Comparison between seed cotton grade of farm number (270) of farmer (Elfadil) seasons (1999-2002)

| Seasons | Yield (K) Per 5Fed | Seed Cotton Grade% | | | | | |
|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI |
| First Season | 33.3 | - | 4.2 | 72.2 | 3.8 | 208 | - |
| Second season | 26.7 | 9.1 | 14.5 | 41.3 | 264 | 8.7 | - |
| Third season | 34.2 | 16.7 | 16.9 | 36.5 | 29.9 | - | - |

K Kanter =315 lb*
* Grade : Based on color, Leaf, Trash and preparation
lower figure indicates better grade *

Table (6) The average staple length (mm) in season 2000/2001 and 2001/2002.

| Fibre Test | Pick | Barac(67)B | | | Barakat-90 | | |
|---|---|---|---|---|---|---|---|
| | | Mean | Range | C.V % | Mean | Range | C.V % |
| Fibre Length (m.m) | One | 28.2 | 27.9-28.5 | 0.22 | 34.7 | 34.4-35.2 | 0.64 |
| | Two | 28.0 | 27.8-28.2 | 0.24 | 34.5 | 34.0-35.0 | 0.66 |
| | Three | 27.7 | 27.6-28.0 | 0.25 | 33.4 | 33.1-33.9 | 1.02 |
| | Control | 27.9 | 25.7-28.3 | 0.82 | 33.9 | 32.1-35.1 | 2.11 |
| Bundle Strength (g/tex) Control | One | 31.13 | 31.0-31.4 | 0.42 | 38.1 | 36.6-38.8 | 1.39 |
| | Two | 30.90 | 30.7-31.0 | 0.50 | 37.9 | 36.1-38.8 | 1.60 |
| | Three | 29.36 | 27.9-30.4 | 0.57 | 36.3 | 35.6-38.5 | 1.64 |
| | | 28.67 | 27.1-30.7 | 1.46 | 36.3 | 34.7-38.2 | 5.01 |
| M.V (m/tex) | One | 4.33 | 4.2-4.5 | 0.08 | 4.10 | 4.0-4.2 | 2.03 |
| | Two | 4.18 | 4.1-4.4 | 0.11 | 4.07 | 3.9-4.2 | 2.05 |
| | Three | 3.85 | 3.8-4.2 | 0.13 | 3.95 | 3.7-4.1 | 2.05 |
| | Control | 4.05 | 3.9-4.3 | 1.39 | 3.95 | 3.5-4.1 | 7.06 |

When scheduled picking and manual cleaning were performed on Barakat-90, the mean fibre length was 34.7mm compared to conventional practice. Mean fibre strength was 30. lg/tex, and the mean ,micronaire value was 4.10 as shown in tables ( 8,6.) With regard to trash content , the mean values for Barac(67)B, scheduled picks and manually cleaned, is 0.32%,ranging between 0.30 and 0.5%compared to l. 14% for the conventional , picking is shown in table (7) and 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%.

As shown In table 8, the mean number of the sticky points in Barac (67)B samples, was (3.9)which was lower than the mean number recorded from conventional practice (38) points . Barakat -90 variety gave a mean number of sticky points (2.4) points in the first pick, (l .6) points in the second pick and (0.9)points in the third pick, while the farmer practice gave a mean number of (20) points. However, Barakat -90 variety was of lesser honeydew contamination than Barac(67)B variety. This might be attributed to the fact that Barakat -90 bolls open late in thus season and escaping the white fly peak infestation.

Tables (9 and 10) shows that the expected difference in returns between scheduled picking and farmer practice for Barac(67)B variety could amount to 1.46 million dollars in season 2000/2001 . Tables II and 12 shows that the estimated difference in Barakat-90 variety could amount to 2.42 million dollars in season 2000/2001 and 8.11 million dollars in season 2001/2002 . The noticeable increased areas devoted to Barakat-90 cotton variety is because Barakat-90 fetches higher prices in cotton markets.

The results in table (13) show a positive trend after process modifications which could result in a gain of about 14.95 million dollars in season 2001/2002 and this is a remarkable benefit to the national economy. However, this could only be obtained when implementing the out come s of this research work.

## RECOMMENDATION

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

l- Scheduled picking and manual cleaning in the field should be adopted in harvesting middle, 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 care should be taken when handling and transporting to the ginning yards (first in first out. )

4- The difference in 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.

Table (7) The average Trash content in season 2000/01 and 2001/2002.

| Pick | Barac(67)B | | | Barakat-90 | | |
|---|---|---|---|---|---|---|
| | Mean | Range | C.V% | Mean | Range | C.V % |
| One | 0.32 | 0.50-0.30 | 0.08 | 0.38 | 0.5-0.2 | 0.11 |
| Two | 0.82 | 0.80-0.50 | 0.17 | 0.65 | 1.0-0.6 | 0.16 |
| Three | 1.50 | 1.10-0.90 | 0.15 | 1.02 | 1.3-0.7 | 0.27 |
| Control | 1.41 | 4.2-3.8 | 3.07 | 3.96 | 5.0-0.7 | 1.03 |

Table (8) The average sticky point number in season (2000/2001 and 2001/2002)

| Pick | Barac(67)B | | | Barakat-90 | | |
|---|---|---|---|---|---|---|
| | Mean | Range | C.V% | Mean | Range | C.V% |
| One | 3.8 | 7-2 | 1.58 | 2.4 | 4-0 | I .40 |
| Two | 2.7 | 4-4 | 1.03 | 1.6 | 4-0 | 1.58 |
| Three | 2.3 | 5-1 | 0.83 | 0.9 | 2-0 | 0.83 |
| Control | 38.0 | 70-20 | 10.03 | 20 | 33-9 | 8.36 |

Table (9) The total yield and returns of Barac (67)B cotton crop in Gezira in season (2000/2001)

| **Grade** | **Weight kantar** | **Percent** | **Price cent/Lb** | **Value (in million Dollars )** |
|---|---|---|---|---|
| Actual 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 | |

The expected returns

| | | | | |
|---|---|---|---|---|
| 1 | 347771 | 64.6 | 35.71 | 12.45 |
| 2 | 110899 | 20.6 | 33.01 | 03.66 |
| 3 | 68908 | 12.8 | 32.95 | 02.27 |
| 4 | 10767 | 02.0 | 29.10 | 00.37 |
| Total | 538347 | 100 | - | 18.75 |

Table (10) The total yield and returns of Barac (67)B cotton crop in Gezira in season (2001/2002)

| **Grade** | **Weight kantar** | **Percent** | **Price cent/Lb** | **Value (in million Dollars )** |
|---|---|---|---|---|
| Actual 1 | 5528 | 10 | 35.71 | 1.97 |
| 2 | 197318 | 369 | 31.01 | 6.12 |
| 3 | 1231934 | 43.3 | 32.95 | 7.64 |
| 4 | 46509 | 8.1 | 29.1 | 1.35 |
| 5 | 7327 | 1.4 | 28.1 | 0.21 |
| Total | 538346 | 100 | | 17.29 |

The expected returns

| | | | | |
|---|---|---|---|---|
| 1 | 108817 | 71.6 | 35 81 | 3.90 |
| 2 | 038603 | 25.4 | 33.01 | 1.27 |
| 3 | 004559 | 03.0 | 32.95 | 0.15 |
| 4 | - | - | - | - |
| Total | 151979 | 100 | - | 5.32 |

Table (11) The total yield and return expected from Barakat-90 cotton crop grown in Gezira in season (2000/2001).

| Grade | Weight kantar | Percent | Price cent/Lb | Value in million Dollars |
|---|---|---|---|---|
| Actual B | 002730 | 0.50 | 84.58 | 0.32 |
| x2 | 003003 | 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 | 005140 | 0.93 | 57.00 | 029 |
| 6 | 004785 | 0.87 | 55.00 | 0.26 |
| C6 | 000253 | 0.05 | 53.00 | 0.01 |
| D6 | 000117 | 0.02 | 50.00 | 0.01 |
| Total | 556456 | 100.00 | | 37.53 |

The expected returns

| | | | | |
|---|---|---|---|---|
| B | 050637 | 09.1 | 84.58 | 04.28 |
| x2 | | | | |
| 2 | 080686 | 14.5 | 75.16 | 06.06 |
| x3 | | | | |
| 3 | 229816 | 41.3 | 75.92 | 17.45 |
| x4 | | | | |
| 4 | 146904 | 26.4 | 62.89 | 09.24 |
| x5 | | | | |
| 5 | 048411 | 08.7 | 60.27 | 02.92 |
| | | | | |
| Total | 556456 | 100 | | 39.95 |

Table (12 )The Total yield and return expected from Barakat-90 cotton crop grown in Gezira in season (2001/2002).

| Grade | Weight kantar | Percent | Price cent/Lb | Value in million Dollars |
|---|---|---|---|---|
| Actual 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 | 1.40 |
| C6 | 31831 | 3.28 | 44.00 | 0.05 |
| D6 | 1204 | 0.12 | 42.00 | 50.92 |
| Total | 970065 | 100 | | 0.12 |

The expected returns

| | | | | |
|---|---|---|---|---|
| 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 | 21.06 |
| x4 | | | 57.99 | |
| 4 | 290049 | 29.9 | 54.76 | 15.88 |
| x5 | | | 50.38 | |
| 5 | - | - | 50.08 | - |
| Total | 970065 | 100 | | 59.03 |

Table (13) The expected benefits From conducting the scheduled cotton picking and manual cleaning in the Gezira Scheme. Seasons (2000-2002)

| Description | Season 2000-2001 | | | Season 2001/2002 | | |
|---|---|---|---|---|---|---|
| | Million dollar | | Million dollar | Million dollar | | Million dollar |
| A-Quality improvement:<br>1-Barac (67)B<br>2-Barakat-90 | <br>1.46<br>2.42 | | | 0.15<br>8.11 | | |
| Sub total | 3.88 | | 3.88 | 8.26 | | 8.26 |
| B -Reducing stickiness:-<br>1-Barac (67)B<br>2-Barakat-90 | <br>2.60<br>5.62 | | | <br>0.77<br>7.64 | | |
| Sub total | 8.22 | | 8.22 | 8.41 | | 8.41 |
| Reducing trash content :-<br>I-Barac (67)B<br>2-Barakat - 90 | <br>1.24<br>1.28 | | | <br>1.75<br>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 of lots | |
| I-Barac (67)B<br>2-Barakat-90 | 092681<br>164380 | 309<br>548 | | 46054<br>285313 | 154<br>951 | |
| Sub total | | 857 | 0.33 | | 1105 | 0.42 |
| Grand total | | | 14.950 | | | 21.180 |

5-Farmers should be encouraged to follow scheduled picking and hand cleaning of cotton.

6-lncentives should be paid to the far mers who carry scheduled picking.

**Recommended farmer practice:-**

I-The cotton should be picked in scheduled picks before it is exposed to the weather or fall on the ground.
2- Picking should be by the first three fingers of the hand. For picking the first three fingers of the hand should be **meed.**
3- good supervision on picking labourers, especially on the youngsters, should be exercised.
4- The heaping of the cotton inside the cotton field should be strictly forbidden. It should be taken directly to the picking square, which is paved or plastered.
5- The cotton should be cleaned before it is pressed in sacks.
6- Cotton collection stations should be kept clean and damaged Saks, if any, should be stitched before despatch to the ginning yards. The first patches of sacks retches the collection station should be
7- despatched first to ginning yard (First in first out).
8- The farmer has to be aware of the grading and marketing system and should receive quick payment .

## REFERENCES

1- Carleson, G.A. and Mohamed , A.(1986).Economic analysis of cotton-insect control in Sudan Gezira.
2- Fadlalla , A.S.(1998), Summary of project Rationale ,.objectives and Execution. Annual Report, C.F.C. Stickiness Project.
3- International Textile manufacturers federation (2003) Cotton contamination survey 2003.1).1.
4- Khalifa,H.(1980).Cotton stickiness International Textile Bulletin. World Edition Spinning 2/806 Khalifa,H.and Gameel f O.L. ,(1982).Control of cotton stickiness
5- Through Breeding cultivars Resistant to whitefly (Bamisia Tobac, Infestation. Improvement of oil-seed industrial crops by induced Mutations,
6- Perkins, H.H. Jr. (1983).Effect of white fly contamination on lint Quality of V.S. Cotton in Proceeding of Belt wide cotton production Research conference p.p.102-103.National cotton council, Memphis, Tennessee.
7- TV Ratnam and K.N. Seshan(1987).Quality control in spinning. The south India Textile Research Association combatore.p. 13.