COTTON CHARACTERISTICS AS AFFECTED BY CLEANING MACHINERY AND TYPE OF GIN-STAND

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Abstract

The present study was conducted to determine the extent of possible damage and adverse effects on fiber and yarn qualities characteristics of Egyptian cottons as subjected to mechanical manipulation by means of gins, seed cotton cleaners and lint cleaners. The four Egyptian cotton varieties Giza 70, Giza 88 (extra long staple varieties), Giza 80 and Giza 89 (long staple varieties) were used as a material for this study. The seed cotton grade used was the same for each variety, i.e. Good-14. The stick machine and incline cleaner were used to clean seed cotton prior to ginning while the Mill-type lint opener cleaner was employed to clean cotton lint subsequent to ginning. (The Rotary Knife gin-stand and the McCarthy gin stand were used in this investigation). The findings of the present study indicated that when seed cotton cleaning and lint cleaning were practiced in combination, the least amount of trash content was attained by both gin-stands. However, the reciprocating knife gin stand appeared to act better with the cleaning machineries than the Rotary Knife gin regarding the degree of cleanliness of cotton attained.

Further, fiber strength, elongation, length [2.5% S.L.] and length uniformity showed the highest decrease in their values when seed cotton cleaning and lint cleaning were applied in combination.

To the contrary, micronaire reading tended to increase whenever the cotton was processed by cleaning machineries. With respect to yarn quality properties, the results obtained revealed that the highest values of yarn strength were achieved when seed cotton cleaning and lint cleaning were conducted in combination. This trend was the same for the 2 gin-stand types used in the study. By contrast, a general tendency of decrease in either the thick places or the thin places and hence an improvement in yarn evenness could be noticed in the 2 gin-stands when cleaning both seed cotton and lint cotton were applied together. However, nep count showed insignificant differences due to ginning and cleaning treatments.

INTRODUCTION

Cleaning and Ginning cotton play an important role in affecting cotton quality. Chapman et al. (1966) studied the effect of some cleaning treatments and found that cotton grades were affected considerably by the combined cleaning treatments of seed cotton and lint which produced higher grades than the treatment of only seed cotton cleaning. Non-lint content followed the same pattern. Where, the non-lint content decreased as the seed cotton or lint was cleaned. Fiber length and length
distribution of the ginned lint were somewhat affected by the cleaning treatments, while most of the differences were insignificant. Youssef et al. (1976) did not find any significant differences in the micronaire reading, fiber span length (2.5%) and yarn strength, due to using the rotary knife gin stand and the McCarthy gin stand in ginning the seed cotton of Giza 70 and Giza 69 varieties. Mahgoub (1981) using the reciprocating gin stand revealed higher values of fiber span lengths (2.5% and 12.5% S.L), length uniformity and lower values of floating fiber index in Giza 68 and Giza 67 varieties as compared to the rotary knife gin stand. He added that the effects of rotary knife gin and reciprocating knife gin on fiber bundle tensile properties and micronaire reading of the two varieties were not significant. Moreover, the cotton ginned by using the reciprocating knife gin produced yarn of higher strength and better appearance grade as compared to the rotary knife gin. Zaied (1981) showed that the cleaning treatments of seed cotton gave greater benefits with the cotton of higher foreign-matter content than with the lower one and with the short staple cotton than with the long staple one. Baker and Griffin (1984) mentioned that ginning and lint cleaning could adversely affect fiber length and length distribution, especially when the fiber moisture content was very low. Since fiber tensile strength was proportional to fiber moisture content fiber breakage increased as moisture content decreased and hence fiber length also decreased. Youssef et al. (1992) reported that no significant differences in fiber, yarn and seed qualities were found, due to ginning the seed cotton by the rotary knife gin or the McCarthy one.

Hugus and Bragg (1992) reported that short fiber content increased by about 4.4% as a result of using bad roller gin-stand. EL-shafie (1995) reported that the gin stand type showed highly significant effect on 2.5% fiber span length and short fiber content. Cotton ginned by using the reciprocating knife gin stand showed slightly higher values of 2.5% S.L. and uniformity ratio and a decrease in short fiber content comparing with the rotary knife gin stand. The two ginning types showed nearly the same values of micronaire reading. Hussein (1999) reported that the rotary knife gin stand gave higher 2.5% fiber span length, than the reciprocating knife one whether the ginned cotton was a long staple or an extra-long staple.

**MATERIALS AND METHODS**

In the present investigation, seed cotton of four varieties, i.e., Giza70, Giza88, Giza 80 and Giza 89 each of Good -1/4 grade from 2001 season were cleaned by the stick machine and inclined cleaner before feeding them to the rotary knife gin stand and to the McCarthy one. Also, the ginned lint was cleaned by the Mill-type lint opener cleaner in order to study their effects on the properties of fiber and yarn. Thus, four
treatments (combinations) obtained as follows:

00 Uncleaned seed cotton combined with uncleaned lint
01 Uncleaned seed cotton combined with cleaned lint
10 Cleaned seed cotton combined with uncleaned lint
11 Cleaned seed cotton combined with cleaned lint

Three replications each of 90 kilograms of seed cotton were ginned by the rotary knife gin stand and the McCarthy one after fixing their moving parts according to the variety and the grade of cotton.

Representative samples of ginned lint were drawn, at random to measure fiber and yarn properties at the cotton research institute, Agric. Res. Center. Fiber and yarn properties were tested under controlled atmospheric condition of (70 ± 2°F) temperature and (65 ± 2 %) relative humidity.

**The following measurements were conducted:**

1. Micronaire reading was determined according to ASTM. D-1448-59, 1984.
2. Fiber strength at 1/8 inch gauge length (g/tex) and fiber elongation (%) were measured on the Stelometer according to ASTM. D-1445-75, 1984.
3. Fiber length: parameters were measured by using the "Digital Fibro graph" according to ASTM, D-1447-83, 1984.
4. Trash content was determined on the microdust and trash analyzer [MDTA3] (ASTM, D. 2812- 95 [02]).

Ring spun carded 60 count yarns using 3.6 twist factor were produced by the standard 69 grams micro-spinning technique used in the spinning research section. Those yarns were tested for yarn strength (LP) using the Good Brand lea tester according to ASTM, D-1578-67. Yarn evenness was measured by the Uster evenness tester according to ASTM, D,1425 - 60, 1984.

Data were statistically analyzed according to the procedures outlined by Snedecor and Cochran (1981). The significance of the differences between means were tested following the least significant difference (L.S.D.) procedure.

**RESULTS AND DISCUSSION**

1- Effect of gin stand type and cleaning machinery on trash content:

From the data recorded in table 1, it is quite evident that there was a consistent pattern of decrease in trash content when either seed cotton cleaning prior to ginning or lint cleaning subsequent to ginning was applied. However the least amount of trash was attained when both seed cotton cleaning and lint cleaning were practiced combined. This pattern was true in all the 4 cotton varieties involved in this study.

Further, it is rather interesting to note that, on average, the seed cotton and lint
cotton cleaners proved to be more effective in reducing trash content when used with the McCarthy gin stand than when used with the Rotary Knife gin stand. This finding implies that the reciprocating knife system of the McCarthy gin would act better in combination with the cleaning machineries regarding the degree of cleanliness attained than when they were used with the Rotary knife gin. The significant decrease in trash content due to the use of cleaning processes could be ascribed to the fact that seed cotton cleaner would remove a sensible amount of heavy trash while lint cleaner would remove additional amount of fine trash. This conclusion agrees with that of Chapman et al. (1968) who pointed out that seed cotton cleaning combined with lint cleaning resulted in the lowest non-lint content.

2 - Effect of gin stand type and cleaning machinery on fiber quality characteristics:

On average, the values of fiber strength, elongation, length (2.5% S.L) and length uniformity tended to decrease due to cleaning of either seed cotton or lint cotton (Table 1). However the highest decrease in these characters was realized when seed cotton cleaning and lint cleaning were applied in combination. This trend was similar for both the Rotary Knife gin and the McCarthy one.

A possible explanation for the highest decrease in fiber strength and elongation that occurred due to the combined treatment of seed cotton and lint cotton cleaning was that the successive mechanical manipulations by means of seed cotton cleaner, gin and lint cleaner that adversely affected the tensile properties of the fibers. In fact, the stresses and the dynamic forces to which the cotton fibers were subjected during these mechanical treatments would likely deteriorate fiber quality characteristics. In such a case, a significant downward trend in fiber strength and elongation would be expected. Also the reduction in fiber length and length uniformity could be possibly ascribed to that, during the mechanical manipulation by the cleaners, a sensible proportion of fibers would be subjected to breakage and as such fiber length would be expectedly reduced, while length irregularity would be correspondingly increased. These results are in accordance with Baker and Griffin (1984) results, while they disagree with Mahgoub (1981) results. Unlike the aforementioned findings of fiber quality properties, the micronaire reading, which basically denotes fiber maturity within a variety tended to increase whenever the cotton was processed by either the seed cotton cleaner or the lint cleaner (Table 1). Nevertheless, the increase in micronaire reading due to cotton cleaning practiced with both gin-stand types used in this study, is in fact attributed to the removal of a proportion of the dead locks during seed cotton cleaning and subsequent ginning process. Further, additional amount of immature fibers in the resultant lint would be removed during lint cleaning.
Accordingly micronaire reading of cleaned cotton would be expectedly increased. This finding was the same regardless of the gin-stand type used. However, this result is in agreement with Youssef et al. (1972) results who indicated that cleaning of both seed cotton and ginned lint increased micronaire reading.

When a comparison was held between the 2 gin-stand types used in this study, it appeared that generally there were no significant differences between the Rotary Knife gin and the McCarthy gin with regard to their effects on fiber strength, elongation, micronaire reading and length uniformity. Yet, length of the fibers produced by McCarthy gin was significantly higher than that of the cotton ginned by the Rotary Knife gin stand (Table 1). 3- Effect of gin stand type and cleaning machinery on yarn quality characteristics:

Table 2 displays the data of yarn strength, nep count, number of imperfections (thick and thin places) and unevenness (c.v.%) for yarns spun from cotton subjected to different treatments (combinations). Including gin stand types, seed cotton cleaning and lint cleaning However, it was evident that on average an increase in yarn strength was achieved when both lint cleaning alone and the combination of seed cotton cleaning and lint cleaning were practiced. The latter treatment gave the highest values of yarn strength and this trend was the same in the 2 gin-stand types. By contrast, the use of seed cotton cleaning alone resulted in a reduction in yarn strength in both gins involved in the study. On the other hand no significant differences in nep count were detected due to ginning and cleaning treatments. Conversely, a general tendency of decrease in either the thick places or the thin places and hence an improvement in yarn evenness could be noticed in both gin – stand types used, when cleaning machineries were employed. The increase in yarn strength due to the combined use of the seed cotton cleaner alongside the lint cleaner could be ascribed to the reduction that took place in the number of imperfections, i.e. the number of thick and thin places, (Table 2). However, it is widely acknowledged that the upgrading of yarn evenness would have a positive impact on yarn strength, since thin places in particular are regarded as weak places along yarn length. Generally, the comparison between the 2 gin-stand types employed in this study revealed that on average no significant differences were found between the 2 gins with respect to their effects on nep count, number of thick places and yarn unevenness. In contrast, the McCarthy gin-stand induced significantly higher number of thin places and produced yarns of better strength (Table 2) than the rotary gin stand.
Table 1. Trash content and fiber qualities as affected with gin-clean type, seed cotton cleaning and lint cleaning processes for four cotton varieties.

<table>
<thead>
<tr>
<th>Treatment Combinations</th>
<th>Trash content (%)</th>
<th>Fiber strength (g tex)</th>
<th>Fiber elongation (%)</th>
<th>Microfibre values</th>
<th>Fiber span length (2.5 %)</th>
<th>Fiber length uniformity (%)</th>
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<tbody>
<tr>
<td>00</td>
<td>4.82</td>
<td>4.95</td>
<td>5.64</td>
<td>5.32</td>
<td>5.16</td>
<td>34.46</td>
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<td>01</td>
<td>4.53</td>
<td>4.22</td>
<td>5.53</td>
<td>4.65</td>
<td>4.74</td>
<td>34.12</td>
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<tr>
<td>10</td>
<td>4.09</td>
<td>3.94</td>
<td>3.67</td>
<td>4.29</td>
<td>4.02</td>
<td>33.28</td>
</tr>
<tr>
<td>11</td>
<td>3.81</td>
<td>3.87</td>
<td>3.32</td>
<td>4.06</td>
<td>3.77</td>
<td>32.02</td>
</tr>
<tr>
<td>General mean</td>
<td>4.31</td>
<td>4.25</td>
<td>4.55</td>
<td>4.61</td>
<td>4.43</td>
<td>33.72</td>
</tr>
</tbody>
</table>

5% L.S.D. 0.38 0.31 0.31 0.35 0.59 0.81

1% L.S.D. 0.51 0.92 0.41 0.49 0.79 1.08

* N.S. = Not Significant.
00 uncleaned seed cotton + uncleaned lint.
01 uncleaned seed cotton + cleaned lint.
10 cleaned seed cotton + uncleaned lint.
11 cleaned seed cotton + cleaned lint.
Table 2. Yarn quality as affected by gin-stand type, seed cotton cleaning and lint cleaning processes for four cotton varieties.

<table>
<thead>
<tr>
<th>Treatment Conditions</th>
<th>Yarn strength (l.f.p.)</th>
<th>Nep count per 120 yards</th>
<th>Thick places per 120 Yards</th>
<th>Thin Places Per 120 Yards</th>
<th>Yarn unevenness (C.V. %)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>G. 70</td>
<td>G. 88</td>
<td>G. 89</td>
<td>Mean</td>
<td>G. 70</td>
</tr>
<tr>
<td>09</td>
<td>2531</td>
<td>2656</td>
<td>1623</td>
<td>2188</td>
<td>2295</td>
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<tr>
<td>01</td>
<td>2614</td>
<td>2698</td>
<td>1740</td>
<td>2216</td>
<td>2317</td>
</tr>
<tr>
<td>10</td>
<td>2570</td>
<td>2615</td>
<td>1612</td>
<td>1180</td>
<td>2247</td>
</tr>
<tr>
<td>11</td>
<td>2688</td>
<td>2719</td>
<td>1794</td>
<td>2214</td>
<td>2344</td>
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<tr>
<td>General Mean</td>
<td>2605</td>
<td>2679</td>
<td>1666</td>
<td>2381</td>
<td>1391</td>
</tr>
<tr>
<td>%</td>
<td>5%</td>
<td>59</td>
<td>N.S.</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>L.S.D.</td>
<td>1%</td>
<td>78</td>
<td>N.S.</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>09</td>
<td>2734</td>
<td>2769</td>
<td>1901</td>
<td>2216</td>
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<tr>
<td>01</td>
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<tr>
<td>10</td>
<td>2660</td>
<td>2657</td>
<td>1821</td>
<td>2218</td>
<td>2341</td>
</tr>
<tr>
<td>11</td>
<td>2733</td>
<td>2752</td>
<td>1981</td>
<td>2297</td>
<td>2444</td>
</tr>
<tr>
<td>General Mean</td>
<td>2727</td>
<td>2739</td>
<td>1901</td>
<td>2257</td>
<td>2408</td>
</tr>
<tr>
<td>%</td>
<td>5%</td>
<td>59</td>
<td>N.S.</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>L.S.D.</td>
<td>1%</td>
<td>78</td>
<td>N.S.</td>
<td>19</td>
<td>17</td>
</tr>
</tbody>
</table>

* N.S.: Not Significant.
00 uncleaned seed cotton + uncleaned lint.
01 uncleaned seed cotton + cleaned lint.
10 cleaned seed cotton + uncleaned lint.
11 cleaned seed cotton + cleaned lint.
REFERENCES


تأثير تنظيف الغزل و نوع الحلاقة على صفاته الغزل المحاجر

أسماء نسيف محمد توفيق

معهد بحوث الغزل - مركز البحوث الثقافية - الجزيرة - مصر

أجريت هذه الدراسة لتقييم مدى الأضرار المحتملة التي يمكن أن تترتب عليها صفات جودة غزلة و خيوط غزل الأقطان المصرية عند تعرضها للمعالات البيوكيميائية الشائعة في حالية الغزل، واستخدام منظفات الغزل (خيوط الغزل) ومنظفات الغزل المشر (خيوط غزر). وقد استخدم في هذه الدراسة أربعة أصناف من القطن المصري هي جزيرة 70 و جزيرة 88 (أقطان طويلة القيمة) و جزيرة 80 و جزيرة 89 (أقطان طويلة القيمة) وكانت رتبة القطن الزهر التي استخدمت موحدا لجميع هذه الأصناف (جودة 74) واستخدم أيضا أعشار من الحلاة ذات السكينة الساوية و الحلاة ذات السكينة الساوية. و قد أشارت نتائج هذه الدراسة إلى أن استخدام منظفات القطن الزهر ومنظفات القطن المشر معا أثر على أقصى إنتاجي من الدواب في اللقين (خيوط غزر) وإصلاح من خلال ارتفاع نسبة الأقلية من القطن ذات السكينة الدواية، إضافة إلى ذلك فإن استخدام منظفات الزهر و المنظفات معا أعلى من الحصول على أقل القطن لإنتاج القطن وتضاعفها وطول القطن وانظام القطن و على الحمض من ذلك قد أدأ إلى زيادة قيم قراءة الميكروني. التي تعتبر أساسا عن تأثير القطن في الدواب محدد واحد، والثانية لصفات جودة خيوط غزر. فقد أشارت النتائج إلى أن استخدام منظفات القطن الزهر والمنشئ معا أعلى من الحصول على أعلى نسبة لخيوط غزل بعد النظر عن نوع الحلاقة المستخدمة، وأيضا لقد أظهرت هذه الدراسة اختلافا في عدد المناطق السجية والمناطق الرفيعة في خيوط الغزل وترتبط مع الأضرار الناتجة عن استخدام هذه الطرق في الدراسة.