Technological Evaluation for Egyptian Cotton Advanced Strains

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ABSTRACT
This study was carried out at the Plant Production Department, Faculty of Agriculture (Saba-Basha), Alexandria University, Egypt and the Cotton Research Institute, ARC, Giza, Egypt. Six commercial Egyptian cotton varieties were under study: Giza 87, Giza 96, Giza 94, Giza 86, Giza 95 and Giza 90. Additionally, three lint cotton grades were estimated for each variety, namely: Good /Fully Good (G/FG), Good +1/4(G+1/4) and Good (G) during the three consecutive seasons 2017, 2018 and 2019 while HVI 1000 (classing) was used for analyzing and measuring the fiber quality parameters. A highly significant difference for the mean squares of the quality parameters for the cotton varieties under study was observed. As well as the three cotton grades and the three growing seasons showed similar behavior for all the cotton fiber properties of the varieties understudy with an exception for the degree of yellowness (+b), fiber length (Upper Half Mean Length – UHML (mm)) and spinning consistency index (SCI) that revealed insignificant differences in the growing seasons. The mean squares of cotton varieties for all studied fiber properties were highly significant differences as well as the three cotton grades and the three growing seasons mannered the same trend for all studied fiber properties as cotton varieties except yellowness degree, fiber length (U.H.M.L) and spinning constant index (SCI) revealed insignificant differences in the growing seasons. Growing seasons (S) had a highly significant effect on all studied fiber properties i.e. the micronaire reading, maturity index, uniformity index, fiber strength, fiber elongation, short fiber index, reflectance degree and degree of yellowness.

INTRODUCTION
Egyptian cotton has an important status among the world's cotton varieties as its superior properties produce the finest yarn quality; where its fiber characteristics play an important role in the performance efficiency of spinning operations. Cotton quality assessment is an important component of the global cotton trade and the expectations of the spinners regarding the technological progress of textile production depend on the properties of quality fiber. The quality of the cotton yarn is highly dependable on the cotton fiber quality. (Gonca and Erhan 2006).
In Egypt, the cotton grading system highly depends on the skills and experience of the classer. Identifying the variety and estimating the grade and the quality of raw seed cotton according to official grade standards is one of the classer's main tasks. However, it was concluded that the grades were highly significant and correlated with the traits under study (direct or indirect) (Nassar et al., 2019).

The quality parameters that were involved in the cotton industry act as a reference to the processing system. The Optimum operating systems depend on the working conditions and the characteristics of fibers such as are length, fineness, strength and elongation.

In addition to the fiber maturity and the number of convolutions of fibers that play vital roles in the cotton industry. Cotton fiber represents about 50% of the cost of yarn as there is a direct correlation between specific fiber quality characteristics and those of the yarn. Traditionally, the cotton price largely depends on key factors such as staple length, grade, color and micronaire. A higher price is usually settled for lint cotton with high-quality parameters and mature fibers (Gerald, 2008).

Aim of the study: Investigate the effect of cotton variety and lint grade on both the fiber properties measured by HVI and the different seasons (2017, 2018, 2019); as well as evaluate the fiber properties for the Egyptian cotton advanced strains.

**MATERIALS AND METHODS**

This study was carried out at Plant Production Department Laboratories, Faculty of Agriculture (Saba-Basha), Alexandria University and Cotton Research Institute, Agricultural Research Center (ARC), Giza, on six Egyptian cotton varieties and three lint grades and some during 2017, 2018 and 2019 season.

Six commercial Egyptian cotton varieties represented the extra-long staple, (ELS) category there are Giza 87 and Giza 96 (over 1 3/8-inch fiber length = > 35 mm), long-staple (LS) category (1 1/4 -1 3/8-inch fiber length = 30:34 mm) included long-staple white i.e., Giza 86, Giza 94 Long-staple creamy i.e., Giza 95 and Giza 90.

Each variety includes three lint grades as follows; Good to Fully Good (G/FG), Good (G) and Fully Good Fair to Good (FGF/G), during 2017, 2018 and 2019 seasons.

<table>
<thead>
<tr>
<th>Cotton genotypes</th>
<th>Pedigree</th>
<th>Color</th>
<th>Category</th>
<th>Original</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giza 87</td>
<td>G. 77 x G. 45 A</td>
<td>White</td>
<td>Extra-long</td>
<td>Egypt</td>
<td>2002</td>
</tr>
<tr>
<td>Giza 96</td>
<td>(G.84x G.70 x 51B) x 562</td>
<td>White</td>
<td>Extra-long</td>
<td>Egypt</td>
<td>2017</td>
</tr>
<tr>
<td>Giza 86</td>
<td>G.75 x G. 81</td>
<td>White</td>
<td>long</td>
<td>Egypt</td>
<td>1996</td>
</tr>
<tr>
<td>Giza 94</td>
<td>G. 86 x 10229</td>
<td>White</td>
<td>long</td>
<td>Egypt</td>
<td>2016</td>
</tr>
<tr>
<td>Giza 95</td>
<td>G.83 x Dandara</td>
<td>Creamy</td>
<td>long</td>
<td>Egypt</td>
<td>2016</td>
</tr>
<tr>
<td>Giza 90</td>
<td>G. 83(G.75 x 5844) x G. 80</td>
<td>Creamy</td>
<td>long</td>
<td>Egypt</td>
<td>2001</td>
</tr>
</tbody>
</table>

**Fiber Properties:**

Lint cotton samples were pre-conditioned for 24 hours, under the standard conditions of (65 ± 2 %) relative humidity and (20 ± 1 C°) temperature before testing. The treatments were arranged in a completely randomized design with three replications. The cotton samples contained approximately 50 kg of ginned lint, in order to perform both fiber and spinning tests.

**A.1. High Volume Instrument (HVI):** was used to determine the fiber physical properties according to the standard method of the ASTM (D 4605-86).
**Technological Evaluation for Egyptian Cotton Advanced Strains**

**Studied Characteristics:**

1. Fiber properties:

<table>
<thead>
<tr>
<th><strong>Table 2:</strong> Fiber cotton properties measured by HVI instrument.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micronaire reading</td>
</tr>
<tr>
<td>Upper Half Mean Length (mm)</td>
</tr>
<tr>
<td>Fiber strength (g/tex)</td>
</tr>
<tr>
<td>Short Fiber index (%)</td>
</tr>
<tr>
<td>Yellowness degree of (+b)</td>
</tr>
</tbody>
</table>

**Statistical Procedures:**

This investigation was conducted as a factorial experiment in a Completely Randomized Design (CRD) with three replicates and analyzed according to (Gomez and Gomez, 1984). The data was computed using the Co Stat program version 6.400, to test differences among the studied mean of treatments, the least significant difference (L.S.D.) was used at 0.05 level of probability.

**RESULTS AND DISCUSSION**

**Fiber Properties as Influenced by the Egyptian Cotton Varieties (V), Cotton Grades (G), Seasons (S) and Their Interactions Measured by HVI Instrument During 2017, 2018 and 2019 Seasons:**

The measured fiber properties measured by the HVI for the Egyptian cotton varieties under study (V), cotton grades (G), seasons (S) and their interactions during 2017, 2018 and 2019 seasons were tabulated in Table (3) showed the mean square of fiber properties as influenced by the Egyptian cotton variety (V), cotton grade (G), seasons and their interactions during 2017, 2018 and 2019 seasons, respectively i.e. micronaire reading, maturity index, fiber length (U.H.M.L), fiber length uniformity, fiber strength, fiber elongation, short fiber index, reflectance degree, degree of yellowness and spinning consistency index. The cotton varieties under study (V) showed a high significance for all fiber properties understudy, as shown in Table (1).

However, the cotton grade (G) recorded a high significance for all properties under study except for the degree of yellowness that recorded an insignificant mean square. In terms of the growing seasons 2017, 2018 and 2019, a high significance was recorded for all fiber properties understudy with an exception for fiber length (U.H.M.L) and the spinning consistency index did not reach to significant level at 0.05 level of probability.

Both the first-order interaction cotton varieties (V) X cotton grade (G) (VxG), cotton varieties (V) X seasons (S) (VxS) and cotton grade (G) X growing seasons (S) (GxS), and second-order interaction cotton varieties (V) X cotton grade (G) X growing seasons (S) (VxGxS) showed similar behavior with a high significance for all fiber properties understudy with an exception of the spinning consistency index, degree of yellowness for (VxG), maturity index and fiber elongation and spinning constant index for (GxS) interaction and spinning consistency index for cotton varieties (V) X growing seasons (S) (VxS) interaction.

These results were compatible with Badr (2003), El-Oraby (2003), Abd El-Gawad (2006), Hassan and Sanad, (2006), Sharma (2014), Tesema and Hussein (2015) and Negm et al. (2016).

Table (4) showed the mean performance of fiber properties affected by the Egyptian cotton varieties under study (V), cotton grades (G) and seasons (S) and their interaction during 2017, 2018 and 2019. Table (3) illustrated the mean squares of fiber properties as
influenced by the Egyptian cotton varieties under study (V), cotton grades (G), seasons (S) and their interactions measured by the HVI during 2017, 2018 and 2019 seasons.

Table 3: Mean squares of fiber properties as influenced by the Egyptian cotton varieties (V), cotton grades (G), seasons (S) and their interactions measured by HVI instrument during 2017, 2018 and 2019 seasons

<table>
<thead>
<tr>
<th>S.O.V</th>
<th>d.f</th>
<th>Micronaire reading</th>
<th>Maturity index</th>
<th>Fiber length</th>
<th>Mechanical properties</th>
<th>Short fiber index</th>
<th>Reflectance degree</th>
<th>Yellowness degree</th>
<th>Spinning constant index (SCI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton variety</td>
<td>5</td>
<td>0.05**</td>
<td>0.002**</td>
<td>244.8**</td>
<td>82.78**</td>
<td>523.08**</td>
<td>18.12**</td>
<td>76.31**</td>
<td>1069.25**</td>
</tr>
<tr>
<td>Cotton grade</td>
<td>2</td>
<td>0.21**</td>
<td>0.11**</td>
<td>0.33 n.s</td>
<td>9.46**</td>
<td>10.72**</td>
<td>31.69**</td>
<td>3.36**</td>
<td>19.44**</td>
</tr>
<tr>
<td>Interaction (VxG)</td>
<td>10</td>
<td>0.77**</td>
<td>0.0018**</td>
<td>0.66**</td>
<td>5.19**</td>
<td>2.44**</td>
<td>0.30**</td>
<td>3.99**</td>
<td>42.50**</td>
</tr>
<tr>
<td>(VxS)</td>
<td>10</td>
<td>0.77**</td>
<td>0.0055**</td>
<td>0.54**</td>
<td>1.88**</td>
<td>6.70**</td>
<td>5.74**</td>
<td>2.48**</td>
<td>55.79**</td>
</tr>
<tr>
<td>(GxS)</td>
<td>4</td>
<td>0.77**</td>
<td>0.00025 n.s.</td>
<td>2.86**</td>
<td>3.21**</td>
<td>2.21**</td>
<td>0.23**</td>
<td>0.37**</td>
<td>12.59**</td>
</tr>
<tr>
<td>(VxGxS)</td>
<td>20</td>
<td>0.06**</td>
<td>0.00002**</td>
<td>0.29**</td>
<td>1.04**</td>
<td>0.40**</td>
<td>0.63**</td>
<td>5.23**</td>
<td>0.31**</td>
</tr>
<tr>
<td>Error</td>
<td>161</td>
<td>Not significant difference at 0.05 level of probability.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n.s: Not significant difference at 0.05 level of probability.
* ** Significant and highly significant difference at 0.05 and 0.01 levels of probability, respectively.

Table 4: Mean performance of fibers properties as affected by the Egyptian cotton varieties (V), cotton grades (G) and seasons (S) and their interactions during 2017, 2018 and 2019 seasons

<table>
<thead>
<tr>
<th>Year</th>
<th>Variety</th>
<th>Micronaire reading</th>
<th>Maturity index</th>
<th>Fiber length</th>
<th>Mechanical properties</th>
<th>Short fiber index</th>
<th>Reflectance degree (Rd.)</th>
<th>Yellowness degree (Yb.)</th>
<th>Spinning constant index (SCI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>Giza 7</td>
<td>3.95</td>
<td>16.20</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>2.60</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 8</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.19</td>
<td>0.96</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 9</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 10</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 11</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 12</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 13</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 14</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 15</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 16</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 17</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 18</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 19</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 20</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>Giza 21</td>
<td>3.75</td>
<td>16.55</td>
<td>32.75</td>
<td>4.29</td>
<td>0.83</td>
<td>3.74</td>
<td>1.94</td>
<td>3.74</td>
</tr>
</tbody>
</table>

n.s: Not significant difference at 0.05 level of probability.
* ** Significant and highly significant difference at 0.05 and 0.01 levels of probability, respectively.

Means within each column followed by the same letter are not a significant difference at 0.05 level of probability

Cotton Varieties (V):

Micronaire Reading And Maturity Index:

Recording the high mean value of micronaire reading (4.29) by cotton variety Giza 90, while the lowest mean value (3.08) was recorded from the cotton variety Giza 87.

With regard to the highest mean value (0.88) of the maturity, the index was recorded by the cotton variety Giza 87, while the lowest mean value (0.83) for the maturity index was obtained by the cotton variety Giza 90.

Fiber Length Measurements:

With concern for fiber length (Length-U.H.M.L- and fiber uniformity index ) recording the highest mean value (34.82mm) of length (U.H.M.L) and (87.7%) of uniformity, the index was recorded by the cotton variety Giza 87, while the lowest mean value (28.57mm)of fiber length(U.H.M.L) and (82.9%) of uniformity index were recorded by the cotton variety Giza 90.
Mechanical Properties:
Concerning mechanical properties, the fiber strength was obtained the highest mean value (43.5 g/tex) for Giza 96, while the lowest mean value (34.5 g/tex) for Giza 95. The Fiber Elongation was obtained the highest mean value (6.8%) for the cotton variety Giza 90, while the lowest mean value (4.7%) was for the cotton variety Giza 86.

Short Fiber Index (SFI):
Regarding Table (4) the cotton variety Giza 95 was recorded the highest mean value (9.13%) for short fiber index, while the lowest mean value (5.40%) was for the cotton variety Giza 86.

Color Attributes:
Respecting the color attributes (Reflectance degree Rd and Yellowness degree +b), the Reflectance degree (Rd) was obtained the highest mean value (77.34) for the cotton variety Giza 96, while, the lowest mean value (64.73) for the cotton variety Giza 95, whereas, Yellowness degree (+b) recorded the highest mean value (12.05) was given by the cotton variety Giza 90, and the lowest mean value (8.74) was given by the cotton variety Giza 96

Spinning Constant Index (SCI):
With respect to the Spinning constant index, the highest mean value (210.2) was estimated for the cotton variety Giza 87, whereas, the lowest mean value (163.0) of the Spinning constant index was obtained by the cotton variety Giza 90.

These results are compatible with El-Oraby (2003), Batisha, Z. Iman (2005), Osman (2007), Karademir et al. (2010), Jacquirine (2016) and Beheary et al. (2018).

Cotton Grades (G):
Concerning the cotton grades in Table (4), the highest cotton grade Good to Fully Good (G/FG) recorded the best values of all-fiber properties which as high value of maturity index (0.87%), fiber length (UHML)(32.96 mm), uniformity index(86.8%), fiber strength (41.8g/tex), fiber elongation (6.2%), spinning constant index (200) and less of micronaire reading(3.66), short fiber index(6.3%) and yellowness degree (9.9) vice versa were undesirable values recorded by cotton grade Good. These results are in harmony with Ibrahim (2013), Ibrahim and El-Banna (2018), and El-Banna (2019).

Growing Seasons (S) :
Growing season 2017 recorded the highest mean values of micronaire reading (3.85), the fiber length (U.H.M.L and uniformity index) (32.45mm) and uniformity index (86.1%), while the lowest mean values obtained in fiber strength, fiber elongation, the Reflectance degree (Rd), and spinning constant index, these values were (39.8g/tex, 5.4%,72.5 and 188, respectively. On the other hand, the growing season 2018 recorded the lowest mean values of micronaire reading, uniformity index, short fiber index, and yellowness degree (3.73), (85.2%), (6.49%) and (9.82+b), respectively, while the highest mean values obtained by maturity index, fiber strength, fiber elongation, and reflectance degree 0.88%, 40.7 g/tex, 6.9% and 74.5 respectively. As well as, the growing season 2019 recorded the highest mean values of short fiber index, yellowness degree, and the spinning constant index 6.93%, 10.2, and 195, respectively, while the lowest mean values recorded with maturity index, the fiber length (U.H.M.L and uniformity index) and (0.85 and 32.31mm, respectively. These results manner the same trend with Abd El-Gelil , Huda (2001), Fouda (2004), Fouk et al. (2008), Bange et al.(2009), Etman, Hanan (2010), Grishanov ( 2011), Mahmoud et al.(2012), and Farooq et al., (2015).
References


تشييم التكنولوجي لسلالات القطن المصري في مراحلها المقدمة.

أجرى هذا البحث في قسم الإنتاج النباتي بكلية الزراعة سابا باشا - جامعة الإسكندرية، ومعالج قسم بحوث الغزل – معهد بحوث القطن بمركز البحوث الزراعية بالجيزة.

تم استخدام ست أصناف من القطن المصري، وقسمت إلى قسمين:

1. القسم الأول الأقطان فائقة الطول والتي يندرج تحتها كل من القطن جيزة 87 وجيزة 96، والثاني الأقطان الطويلة والتي يندرج تحتها جيزة 94، جيزة 86، جيزة 90، وجيزة 95.

وتم التحليل النسبي للعديد من الصفات الفسيحة للمواسم الثلاثة من 2017 إلى 2019. أظهرت نتائج البحث ما يلي:

• اختلفت متوسطات أصناف القطن في جميع خواص الألياف المدروسة أختلاف عالي المعنوية خلال مواسم الدراسة الثلاثة.

• أظهرت متوسطات رتب القطن لجميع خواص الألياف المدروسة فروق عالية المعنوية خلال مواسم الدراسة الثلاثة فيما عدا درجة الأصفرار (b).

• كما أن متوسطات الرتب المختلفة لجميع خواص الألياف المدروسة سجلت فروق عالية المعنوية فيما عدا طول الشعيرات (UHML) وثابت الغزل (SCI).

• لوحظ أن موسم 2017 أعطى أعلى القيم لمعظم الصفات المذكورة فيما عدا ثابتْ الغزل (SCI).

• أعلاذ اختلافات عالي المعنوية في جميع الصفات المدروسة (GxS).

• أيضًا وجد أن التفاعل بين متوسطات كل من الرتب والأصناف ومواسم الزراعة المختلفة (VxGxS) أعطى أعلاذ اختلافات عالي المعنوية في جميع الصفات المدروسة (SCI).

• أعلاذ اختلافات عالي المعنوية في جميع الصفات المدروسة فيما عدا ثابتْ الغزل (SCI).

• سجل التفاعل بين متوسطات الرتب خلال مواسم الزراعة المختلفة (GVxS) أعطى أعلى القيم للعديد من الصفات المذكورة فيما عدا ثابتْ الغزل (SCI).

• سجل اختلافات عالي المعنوية في جميع خواص الألياف المدروسة ماعدا درجة الأصفرار (b).

• سجل اختلافات عالي المعنوية في جميع خواص الألياف المدروسة ماعدا ثابتْ الغزل (SCI).

• أعلاذ اختلافات عالي المعنوية في جميع الصفات المدروسة ماعدا ثابتْ الغزل (SCI).

• أعلاذ اختلافات عالي المعنوية في جميع الصفات المدروسة ماعدا ثابتْ الغزل (SCI).

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• أعلاذ اختلافات عالي المعنوية في جميع الصفات المدروسة M.A.A et al.