GENOTYPIC STABILITY FOR THE NEW EGYPTIAN COTTON VARIETIES GIZA 85, GIZA 86, GIZA 89, GIZA 87 AND GIZA 88

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Abstract

The present investigation aimed to determine genotypic stability for some Egyptian cotton varieties under different environments. Five regional trials were carried out with Egyptian cotton varieties in 1995 and 1996 seasons. Each single trial was grown in a randomized complete block design with four replications. All characters showed highly significant mean squares for varieties, environments and variety x environment interaction.

Average genotypic stability indices were recorded for seed and lint cotton yield for Giza 86, Giza 87, Giza 88; boll weight for Giza 85 and Giza 87; seed index for Giza 85, Giza 86 and Giza 89; micronaire reading for Giza 88; yarn strength for Giza 86, while all varieties under study were unstable for 2.5% and 50% span length.

INTRODUCTION

Cotton as well as many field crops, is greatly influenced by seasonal and environmental fluctuations. In order to obtain consistently better yield and good quality, plant breeders prefer to produce varieties that have a wide adaptation. In this respect, El-Kadi et al. (1978) evaluated 13 Egyptian cotton cultivars and lines which showed different degrees of genotypic stability. El-Marakby et al. (1986) found that all studied characters showed highly significant mean squares for environments, varieties and genotype by environment interaction. Genotypic stability analysis showed that the most stable Egyptian varieties over the six environments were Giza 69, Giza 67 and Giza 80. These varieties were the highest yielders among all other Egyptian varieties and exhibited the highest number of stable characters among which the seed cotton yield was the most important.

Abd El-Rahman and El-Mazar (1987) found that the most stable varieties over
eight environments were Giza 76, Giza 45, Giza 70, Giza 77 and Giza 69. These varieties exhibited the highest number of stable characters. Awaad (1989) and Abou-Zahra et al. (1989) showed that the relatively unpredictable component of variance for the genotype-environment interaction may be more important than the relative predictable component. Estimates of genotypic stability revealed varying degrees of stability for the different genotypes.

Awaad et al. (1994) reported information on genotype environment interaction derived from data on 6 yield components in 28 genotypes grown at seven locations in Middle and Upper Egypt in 1992. The best three genotypes were F5-148/90, F5-160/90 and F6-197/90 which were stable for all traits recorded. The new cultivar Giza 83 was the highest yielding and most stable commercial cultivar.

El-Shistawy et al. (1994) found average genotypic stability degrees for boll weight, lint index and lint/boll for Giza 69, boll weight for the promising hybrid Giza 75 x (44 x C.B. 58) and lint percentage for the hybrid Giza 67 x C.B. 58.

Seyam et al. (1994) recorded average genotypic stability degrees for seed index and micronaire reading for Giza 76, Giza 80, Giza 81 and Giza 83, lint percentage for Giza 83 and lint index for Giza 81 while most varieties were unstable for seed cotton yield, lint yield per plant, boll weight, lint percentage, lint index and fiber strength traits.

Abo-tour et al. (1996), based on data all over environmental means of Giza 85 cultivar, stated that the high yielding genetic potential and the recorded wide adaptability supported the evidence that this cultivar may be recommended to be included in any breeding program for improving lint yield and lint percentage.

The present study aims to determine the genotypic stability for some agronomic and fiber characteristics for the new Egyptian cotton varieties Giza 85, Giza 86, Giza 89, Giza 87 and Giza 88.

**MATERIALS AND METHODS**

Five Egyptian cotton varieties namely Giza 85, Giza 86, Giza 89, Giza 87 and Giza 88 were planted at five locations i.e., Kafr El-Sheikh, El-Rehairah (Damanhur), El-Ghorbia (Tanta), El-Dakhila (Meat Gharra) and El-Sharkia, in two successive seasons (1995 and 1996). A randomized complete block design with four replications was used at each location. Plot size consisted of five rows four meter long, and 60
cm apart. Distance between hills was 20 cm and each hill was thinned to two plants. Cultural practices were carried out as recommended. The characters studied were seed cotton yield per plot, lint yield per plot, boll weight, lint percentage, seed index, fiber length, micronaire reading and fiber strength.

Statistical analysis:

The genotypic stability analysis was done according to the method described by Tai (1971). A combined analysis of variance was carried out for each character with fixed variety effects and random replicate and environmental effects.

Stability parameters \( \alpha_i \) and \( \lambda_i \) were estimated for each variety separately by using the following equations:

\[
\alpha_i = \frac{S^1_{(g1)i}}{(MSL - MSB) / Vr}
\]

\[
\lambda_i = \frac{S^2_{(g1)i} - \alpha_i S_{(g1)i}}{(V - 1) MSE / Vr}
\]

where

- \( \alpha_i \) = The linear response of the ith variety to the environmental effect.
- \( \lambda_i \) = The deviation from the linear response of the ith variety to the environmental effect.

\( S^1_{(g1)i} \) = The sample covariance between the environment and interaction effects,

\( S^2_{(g1)i} \) = The sample variance at the interaction effect of the ith variety to the ith environment.

\( i \) = The environmental effects.

\( (G)_{i} \) = The interaction effect of the ith variety.

\( MSL \) = Mean square of environments.

\( MSB \) = Mean square for replicates within environments.

\( MSE \) = The mean square for error.

\( r \) = Number of replicates.

\( v \) = Number of genotypes.

A perfectly stable cultivar will not change its performance from one environment to another. This is equivalent to stating that \( \alpha_i = -1 \) and \( \lambda_i = 1 \). Perfectly stable cultivars probably do not exist and plant breeders will have to be satisfied with obtainable levels of stability, i.e. average stability \( \alpha_i = 0 \) and
lambda i = 1). Denoting the tabulated value of the probability level a (a = 1-p) with (n-2) degrees of freedom, as ta the prediction limits for alpha i corresponded to alpha i = 0 can be shown to be

$$
\pm t^2a = \left[ \frac{\lambda \cdot O \cdot (V-1) \cdot MSE \cdot MSL}{(MSL - MSE) \cdot (n-2) \cdot MSL - (t^2a + n-2) \cdot MSE} \right]^{1/2}
$$

Lambda 0 = 1 the confidence interval at the probability level P is Fa (n2, n1) ≤

where

- Fa (n2, n1) = 1/Fa (n1, n2)
- n1 = n-2 degrees of freedom
- n2 = n (V-1) (t-1) degrees of freedom
- a = 1-P
- and P = 0.90

**RESULTS AND DISCUSSION**

The results of the combined analysis of variance for all characters are shown in Table (1). The environment, variety and variety x environment interaction mean squares were highly significant for all studied characters.

These results indicate that: (a) As an average over all tested environments, all characters showed significant difference among varieties, and (b) for all characters, the varieties responded differently at the different environments.

For all characters, variety means in addition to the estimates of the parameters $ai$ and $\lambda i$ for each variety are presented in Table (2). It is clearly shown that: (a) The relative ranking of varieties according to their mean performance over the environments were not the same for all characters; and (b) the estimated $ai$ statistics ranged from -1 and +1 for all characters.

The distribution of $ai$ and $\lambda i$ values are shown in Figs.1-9.

For seed cotton yield, lint cotton yield, boll weight, lint percentage, seed index, 2.5 span length, 50% span length, micronaire reading and yarn strength, respectively. From the distribution of $ai$ and $\lambda i$ statistics, it could be seen that (a) mostly, the estimated $ai$ statistics for different varieties, do not differ significantly from $a = 0$, and b. the varieties varied greatly in the estimated $\lambda i$ statistics. There-
<table>
<thead>
<tr>
<th>Source of variance</th>
<th>Seed cotton yield/plot</th>
<th>Lint yield per plot</th>
<th>Boll weight (g)</th>
<th>Lint percentage (%)</th>
<th>Seed index</th>
<th>2.5% span length (mm)</th>
<th>50% span length (mm)</th>
<th>Micronaire reading</th>
<th>Yarn strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment (E)</td>
<td>38.5193**</td>
<td>5.6376**</td>
<td>1.2508**</td>
<td>15.0357**</td>
<td>17.6899**</td>
<td>3.5678**</td>
<td>1.1175**</td>
<td>3.2638**</td>
<td>374332.2**</td>
</tr>
<tr>
<td>Rep. within Env.</td>
<td>0.7742**</td>
<td>0.1188**</td>
<td>0.0201</td>
<td>1.0731</td>
<td>0.3754</td>
<td>0.0816</td>
<td>0.0282</td>
<td>0.0289</td>
<td>9420.875</td>
</tr>
<tr>
<td>Genotypes (G)</td>
<td>5.3967**</td>
<td>1.915**</td>
<td>0.5754**</td>
<td>258.7997**</td>
<td>12.2733**</td>
<td>195.7583**</td>
<td>52.0139**</td>
<td>4.8413**</td>
<td>2456322**</td>
</tr>
<tr>
<td>E x G</td>
<td>0.6379**</td>
<td>0.1164**</td>
<td>0.0621**</td>
<td>2.1929**</td>
<td>0.7559**</td>
<td>0.6689**</td>
<td>0.3308**</td>
<td>0.1719**</td>
<td>46491.52**</td>
</tr>
<tr>
<td>Pooled error</td>
<td>0.356</td>
<td>0.0495</td>
<td>0.0267</td>
<td>0.5836</td>
<td>0.3112</td>
<td>0.09</td>
<td>0.0325</td>
<td>0.0157</td>
<td>7154.481</td>
</tr>
</tbody>
</table>

* and ** Significant at 5% and 1% for pooled error, respectively.
Table 2. Variety means over environments and estimates of stability parameters (\(a_i\) and \(\bar{u}\)).

<table>
<thead>
<tr>
<th>Traits</th>
<th>Giza 85</th>
<th>Giza 86</th>
<th>Giza 89</th>
<th>Giza 87</th>
<th>Giza 88</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed cotton yield (kg/p)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>3.81</td>
<td>4.11</td>
<td>3.75</td>
<td>3.14</td>
<td>3.94</td>
</tr>
<tr>
<td>ai</td>
<td>0.0335</td>
<td>0.1736</td>
<td>0.0109</td>
<td>-0.2023</td>
<td>-0.0157</td>
</tr>
<tr>
<td>(\bar{u})</td>
<td>1.2068</td>
<td>10.1038</td>
<td>2.8997</td>
<td>1.0716</td>
<td>0.7552</td>
</tr>
<tr>
<td>Lint yield (kg/p)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>1.48</td>
<td>1.60</td>
<td>1.40</td>
<td>1.03</td>
<td>1.49</td>
</tr>
<tr>
<td>ai</td>
<td>0.0395</td>
<td>0.2349</td>
<td>0.008</td>
<td>-0.2897</td>
<td>0.0073</td>
</tr>
<tr>
<td>(\bar{u})</td>
<td>1.0487</td>
<td>1.2363</td>
<td>3.6195</td>
<td>0.8716</td>
<td>1.0528</td>
</tr>
<tr>
<td>Boll weight (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>2.90</td>
<td>3.03</td>
<td>2.82</td>
<td>2.71</td>
<td>2.94</td>
</tr>
<tr>
<td>ai</td>
<td>0.192</td>
<td>0.0707</td>
<td>0.2591</td>
<td>-0.3267</td>
<td>-0.1951</td>
</tr>
<tr>
<td>(\bar{u})</td>
<td>1.4547</td>
<td>2.398</td>
<td>1.6937</td>
<td>0.8094</td>
<td>2.3833</td>
</tr>
<tr>
<td>Lint percentage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>38.85</td>
<td>38.69</td>
<td>37.49</td>
<td>32.66</td>
<td>37.78</td>
</tr>
<tr>
<td>ai</td>
<td>-0.3308</td>
<td>0.4834</td>
<td>0.3041</td>
<td>0.0364</td>
<td>-0.4031</td>
</tr>
<tr>
<td>(\bar{u})</td>
<td>2.1325</td>
<td>0.8905</td>
<td>4.2201</td>
<td>2.7121</td>
<td>4.7651</td>
</tr>
<tr>
<td>Seed index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>10.13</td>
<td>10.75</td>
<td>9.42</td>
<td>9.74</td>
<td>10.57</td>
</tr>
<tr>
<td>ai</td>
<td>0.2665</td>
<td>0.1344</td>
<td>0.0595</td>
<td>-0.2338</td>
<td>-0.2066</td>
</tr>
<tr>
<td>(\bar{u})</td>
<td>1.6609</td>
<td>1.3048</td>
<td>1.5819</td>
<td>2.7054</td>
<td>2.1148</td>
</tr>
<tr>
<td>2.5% span length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>30.16</td>
<td>31.84</td>
<td>31.46</td>
<td>35.11</td>
<td>34.94</td>
</tr>
<tr>
<td>ai</td>
<td>-0.0941</td>
<td>0.4039</td>
<td>0.0122</td>
<td>0.0993</td>
<td>-0.4213</td>
</tr>
<tr>
<td>(\bar{u})</td>
<td>3.4162</td>
<td>7.9229</td>
<td>11.1161</td>
<td>8.3364</td>
<td>2.8442</td>
</tr>
<tr>
<td>50% span length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>15.10</td>
<td>15.76</td>
<td>15.65</td>
<td>17.51</td>
<td>17.55</td>
</tr>
<tr>
<td>ai</td>
<td>-0.0902</td>
<td>-0.1237</td>
<td>-0.0641</td>
<td>0.6377</td>
<td>-0.3597</td>
</tr>
<tr>
<td>(\bar{u})</td>
<td>4.4245</td>
<td>11.6494</td>
<td>8.8637</td>
<td>6.0903</td>
<td>4.1353</td>
</tr>
<tr>
<td>Micronaire reading</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>3.61</td>
<td>3.87</td>
<td>3.91</td>
<td>3.06</td>
<td>3.77</td>
</tr>
<tr>
<td>ai</td>
<td>0.1926</td>
<td>0.069</td>
<td>0.1503</td>
<td>-0.3836</td>
<td>-0.0282</td>
</tr>
<tr>
<td>(\bar{u})</td>
<td>11.6538</td>
<td>7.7646</td>
<td>5.8414</td>
<td>7.4108</td>
<td>1.0128</td>
</tr>
<tr>
<td>Yarn strength</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>2370</td>
<td>2460</td>
<td>2305</td>
<td>2850</td>
<td>2785</td>
</tr>
<tr>
<td>ai</td>
<td>0.2198</td>
<td>0.0466</td>
<td>-0.2391</td>
<td>0.4647</td>
<td>-0.4910</td>
</tr>
<tr>
<td>(\bar{u})</td>
<td>4.8272</td>
<td>1.2731</td>
<td>5.2808</td>
<td>6.6205</td>
<td>7.2950</td>
</tr>
</tbody>
</table>

Plot area = 12 m².
fore, it could be concluded that relatively unpredictable component (the deviation from the linear response, \( \lambda \)) of the genotype \( x \) environment interaction variance may be more important than the relatively predictable component (the linear response, \( \omega \)).

The varieties showed different degrees of genotypic stability for the different characters as follows:

1. Giza 85 showed average degrees of stability for seed and lint cotton yield/plot, boll weight and seed index. It was unstable for the other characters.

2. Giza 86 showed average degrees of stability for seed and lint cotton yield/plot, lint percentage, seed index and yarn strength. It was unstable for the other characters.

3. Giza 89 showed average degrees of stability for seed index. It was unstable for the other characters.

4. Giza 87 showed average degrees of stability for seed, lint cotton yield/plot and boll weight. It was unstable for other characters.

5. Giza 88 showed average degree of stability for seed lint, cotton yield/plot and micronaire reading. It was unstable for the other characters.

These results are in agreement with those obtained by El-Kady et al. (1978), El-Marakby et al. (1986), Abdel-Rahman and El-Mazar (1987), Abou-Zahra et al. (1989), Awaad (1989), El-Shishtawy et al. (1994) and Seyam et al. (1994). They found that cotton varieties showed different degrees of genotypic stability for agronomic and fiber characteristics.
Fig. 1. Distribution of estimated stability, where:

1. Giza 85,
2. Giza 86,
3. Giza 89,
4. Giza 87, and
5. Giza 88
Fig. 2. Distribution of estimated genotypic stability, where:

1. Giza 85,
2. Giza 86,
3. Giza 89,
4. Giza 87, and
5. Giza 88
Fig. 3. Distribution of estimated genotypic stability where:

4. Giza 87, and 5. Giza 88
REFERENCES


الأثاث الوراثي للأصناف الحديثة من القطن المصري
(جيزرة 85، جيزرة 86، جيزرة 89، جيزرة 87 وعربية 88)

ساهم محمد مدر

معهد بحوث القطن، مركز البحوث الزراعية، الجيزة.

أجري هذا البحث لإعداد دراسة أثاث الوراثي في أصناف القطن المصري الحديثة وهي ثلاث أصناف من طبقة طول الثدي (جيزرة 85، جيزرة 86 وعربية 88) وستناف من طبقة فاتق الطول (جيزرة 87 وعربية 88). وتناول هذا البحث دراسة سلوك هذه الأصناف وتقييم درجة الأثاث الوراثي لها في بعض محافظات الوجه البحرى من جمهورية مصر العربية (كفر الشيخ - البحرية - الغربية - الدقهلية - الشرقية) خلال موسم الزراعة 1996 و

1997 مع استخدام تجميع عبوات الكاملة العشوائية في أربعة مكررات لكل بيئة من هذه البيئات. وكانت الأصناف الوراثية هي محصول القطن الزمرد - محصول القطن البحري - معدل الحياج - محصول البحري - طول الثدي عند نسبة توزيع (85%)

و (95%) قراءة الميكروني - مائدة الشتلة.

ويمكن تفسير النتائج ليحصل عليها فيما يلي:

كانت الفروق بين الأصناف (متوسطات لكل البيئات الوراثية) عالية المدى للكل الصنف ساكنة بالذكر. وكذلك كان تأثير البيئات على كل الصنف الوراثي عالية المدى. كما أوضحت النتائج أن لكل الأصناف أظهرت إ_TW_BIO Template Stringification_

للبيئات المختلفة. أي أن تأثير كل من الصنف والبيئة وتفاعل الصنف مع البيئة كان عالي المدى على الصنف الوراثي.

أوضحت النتائج أن الصنف جيزرة 85 كان متوسط في الأصناف الوراثي لصنف محصول القطن الزمرد والبحري وصنف جيزرة 87. أما الصنف جيزرة 87 فقد كان متوسط الأصناف الوراثية لصنف محصول القطن الزمرد والبحري. وصنف جيزرة 89 كان متوسط في الأصناف الوراثي لصنف محصول القطن الزمرد والبحري. وكان متوسط في الأصناف الوراثي بالنسبة لصنف محصول القطن الزمرد والبحري وقراءة الميكروني.