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EGYPTIAN ACADEMIC JOURNAL OF
BIOLOGICAL SCIENCES
BOTANY

ISSN 2090-3812

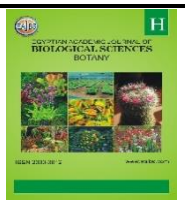
www.eajbs.com

Vol. 15 No.1(2024)

Citation: Egypt. *Acad. J. Biolog. Sci.* (H. Botany) *Vol.15(1) pp 53-67(2024)*
DOI: 10.21608/EAJBSH.2024.356064

Egypt. Acad. Journal Biology. Sci., 15(1):53- 67(2024)

Egyptian Academic Journal of Biological Sciences
H. Botany
ISSN 2090-3812
www.eajbsh.journals.ekb.eg.



Technological Characteristics of Some Egyptian Cotton Varieties as affected by Cultivation Regions

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ARTICLE INFO

Article History
Received:23/4/2024
Accepted:25/5/2024
Available:29/5/2024

***Keywords*:**
Egyptian cotton, seasons, locations, technological characteristics, fiber properties.

ABSTRACT

The study investigates the technological characteristics of some Egyptian cotton varieties, under planting seasons, location, and their interactions. It aims to evaluate how variations in cultivation locations and seasons impact the observed differences in fiber attributes, as well as how the studied varieties adapt to diverse environmental conditions. The study also investigates the interaction between different growing seasons and locations and its effects on the varieties under scrutiny. A randomized block design (RCBD) with four replications was used during two seasons (2018 and 2019) at multiple locations across Egypt, including El-Behira, El-Munofeya, El-Gharbia, Kafr El-Sheikh, El-Dakahlia, El-Sharkeya, Beni Suef, Fayoum, and El-Menya. Results indicate significant variations in fiber properties influenced by seasonal variations and specific growth locations, highlighting the importance of considering these factors in cotton cultivation practices. Results revealed significant influences of seasonal changes on traits such as strength, elongation, and spinning consistency index (SCI) for Giza 86 and Giza 94, while Giza 95 primarily showed effects on short fiber index and neps count. Furthermore, varying growth locations exhibited differential effects on specific traits of Giza 86, with notable variations observed in fiber maturity and strength across locations. Additionally, the interaction between cultivation season and growth location significantly influenced fiber traits, highlighting the importance of considering both factors in cotton cultivation.

INTRODUCTION

Cotton, a soft essential fiber, belongs to the *Malvaceae* family. One of the world's most significant agricultural commodities plays a vital role in global economies and sustains the lives of millions of people worldwide develops as a boll surrounding the seeds of the cotton plant (*Gossypium* sp.), which is a bush that naturally grows in tropical and subtropical regions across the world.

For successful cultivation, cotton needs lots of sunshine and a longer frost-free period. Climate, soil structure, irrigation, fertilization, plant density, weed and insect infections, and fertilization are some of the environmental factors that affect the quality of cotton fiber (Darawsheh *et al.*, 2022).

Environmental and genetic factors influence the physical properties of cotton fibers. Global factors influence not only intermediate and finished products such as yarns and

fabrics but also textile industrial processes and end products. Since raw cotton accounts for a significant portion of textile production costs, price is the most closely examined fiber properties H. Wang *et al*., (2020).

Recently, cotton production has increased significantly in Egypt, the country where the plant has been grown since ancient times. Egyptian cotton, or (*Gossypium barbadense*), is considered a particularly long-lasting staple crop and is valued for its exceptional quality, which earns it a special place in the global market.

The characteristic outer surface of Egyptian cotton fibers and the ideal growing environment in the Nile Valley influence the quality of the harvest. To improve the quality of cotton and the purity of seeds, the Egyptian government took over the production of cotton seeds.The two types of environmental variations that affect cotton quality characteristics are predictable and unpredictable. For the cotton producer, the cotton yield and its components enjoy a limitless reputation. Therefore, the different environments in the extended region are affected differently from environment to environment and season to season El-Seidy *et al*., (2018).

Cotton farming on a global scale faces constraints not only in terms of land availability but also due to limited water resources and the extensive use of pesticides, fungicides, and herbicides variations in qualitative traits studied were predominantly attributed to the impact of the environment and the interplay between the environment and the season. The unique characteristics of cotton produced in each region arise from the intricate influence of numerous interacting factors, underscoring the need for additional research in this field. Darawsheh *et al*., (2022).

The Cotton Arbitration and Testing General Organization (CATGO) which is following the Egyptian government, identifies ten different varieties of cotton that belong to two categories: extra-long staple and long staple. In terms of plantingzones, long-staple varieties are cultivated in the Delta region and in Upper Egypt.

The cotton crop in 2018-2019 has significantly improved in terms of quality and physical properties and this improvement is expected to continue in 2019-2020. The government's efforts in this regard have been evident. This development is confirmed by a CATGO analysis of the physical fiber properties of Egyptian cotton varieties. The cotton produced in the season (2019) has improved compared to the cotton produced in the season (2018) in terms of length, strength, fineness, color, waste count and maturity according to Shaza (2020).

The Main Objectives Are Following:

1. Factors affecting the characteristics of the cotton varieties under study.
2. Evaluate how growing season, planting location, and their interactions collectively influence the observed differences in fiber properties.
3. Determine how the varieties under study adapt and maintain their quality in different environmental conditions.
4. Examining how the interaction between different growing seasons and locations impacts the studied varieties.

MATERIALS AND METHODS

This study examined the effects of the cultivation area on the technological characteristics of some Egyptian cotton varieties using three long staple cultivars. The research was conducted in the summers of 2018 and 2019 at the Cotton Arbitration and Testing General Organization (CATGO) laboratories in Alexandria, Egypt, and at the Plant Production Department, Faculty of Agriculture (Saba-Basha), Alexandria University.

1. Materials:

Three commercial long-staple Egyptian cotton varieties, originating from (*Gossypium barbadense*) represent one of the two categories of Egyptian cotton. This group represented the long staple category with a length range of (1 1/4 - 1 3/8 inch i.e., fiber length = 30-34 mm). However, in terms of color category, two cultivars under study Giza 86, and Giza 94 belong to the white category and Giza 95 stands for the creamy.

These varieties were selected based on the regional classification of cultivated cotton varieties. The cotton was grown in nine production locations in Egypt. Giza 86 was cultivated in (El-Behira, El-Munofeya and El-Gharbia), Giza 94 in (Kafr El-Sheikh, El-Dakahlia and El-Sharkeya), and Giza 95 in (Beni Suef, Fayoum and El- Menya) over two consecutive seasons (2018 and 2019). A complete randomized block design with four replications.

Table 1: The pedigree and origin of the three cotton genotypes.

Cotton genotypes	Pedigree	Color	Category	Original	Year
Giza 86	(G. 75 x G. 81)	White	long	Egypt	1996
Giza 94	G. 86 x10229)	White	long	Egypt	2016
Giza 95	(G.83xDandara)	Creamy	long	Egypt	2016

2. Fiber Properties:

To ensure excellent outcomes, manual and instrument classification were closely supervised. The Cotton Arbitration and Testing General Organization's (CATGO) Fiber and Spinning Testing Sector laboratories in Alexandria, Egypt are the primary locations for quality monitoring.

3. Characteristics Under Study:

Sample Conditioning:

In order to balance the samples' moisture content with the permitted air conditions. The samples' moisture content was reduced by this conditioning procedure to between 6 and 8 percent (dry weight basis). The appropriate moisture content is verified by randomly inspecting the conditioned samples. For the fiber and spinning tests, about 50 kg of ginned lint cotton samples were used.

Laboratory Conditioning:

The temperature and humidity levels in the classing laboratory are strictly regulated to guarantee precise measurement of the properties of cotton fiber. After that, the sample was subjected to typical laboratory settings. for the HVI instrument and ISO 139 Standard atmospheres for conditioning and testing.

(i.e., temperature 21°C ± 1°C at a qualified humidity of 65% ± 2%).

I- High Volume Instrument (HVI classing 1000) Fiber Properties:

1. Micronaire reading.
2. Maturity index (%).
3. Upper Half Mean Length, (UHML) (mm).
4. Uniformity index (%).
5. Fiber strength (g /Tex).
6. Fiber elongation (%).
7. Reflectance degree (Rd).
8. Yellowness degree (+b).
9. Trash Count (Tr Cnt) (%).
10. Trash Area (%) (Tr Area).
11. Short Fiber index (%).
12. Spinning Consistency Index (SCI): it calculated direct from HVI by equation:

SCI = -414.67 + (2.9×Strength) - (9.32×Micromaire) + (49.17 × UHML) + (4.74×UI) + (0.65×Rd) + (0.36×Yellowness degree). (Tesema and Hussein, 2015).

II-Uster Nep Tester 720 Instrument:

To count Cotton fiber neps which are created when fibers are tangled together and form a hard-central knot.

III-Micromat:

It is one of the latest electronic devices to measure softness (hair weight).

4. Statistical Procedures:

This investigation was conducted in a randomized complete blocks design with four replicates and analyzed as a factorial experiment according to the technique of Analysis of variance (ANOVA), which was performed according to the method described by (Gomez and Gomez,1984). The data was computed using the CoStat program version 6.400, (2005). To test differences among the studied means of treatments, the least significant difference (L.S.D.) was used at 0.05 and 0.01 levels of probability using the method described by (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

1 The first cotton variety Giza 86:

1.1 The Mean Square of Cotton Variety Giza 86 as Affected by Growing Seasons, Location and Their Interactions:

The presented data in Table (2) showed that significant differences or highly significant mean squares were obtained of seasons for micronaire reading, maturity index, fiber strength, fiber elongation, yellowness degree (+b), short fiber index, hair weight and spinning consistency index (SCI).

The same trend was found for the cultivation location of the above-mentioned fiber properties except for fiber elongation, trash count and trash area.

The significance of mean square for seasons and locations is due to differences in the growing season from one season to another as well as Governorate variance to another.

On the other side, fiber length (U.H.M.L), short fiber index and neps count revealed significant differences in the order interaction between growing seasons and locations meanwhile the rest of the fiber properties did not differ significantly differences.

These results were in the same trend as those of, Mohamed *et al.* (2003) Abdalla *et al.* (2005), Hassan *et al.* (2012), Idris (2012), Lingaiah *et al.* (2020) and Nassar *et al.* (2021), The research revealed highly significant differences in the mean square values of cotton varieties across all studied fiber properties, as well as between the two growing seasons.

Table 2: Mean squares of some fiber properties of the cotton variety GIZA 86 as affected by growing season(S), growing Locations (L) and their interactions during seasons 2018 and 2019.

S.O.V	d.f	Micronair reading	Maturity index	Fiber Length (UHML)	Fiber Uniformity	Fiber Strength	Fiber Elong.	Reflectance degree (Rd)	Yellowness degree (+b)	Trash count	Trash area	Short fiber index	Hair waight	spinning consistency index	Neps count
Blocks	3	0.04	0.0001	0.21	0.92	0.14	0.20	1.08	0.13	486.94	0.080	0.04	36.50	19.77	154.94
Season (S)	1	0.43 *	0.0005 *	0.23 ns	2.66 ns	22.62 **	2.73 **	2.34 ns	2.28 **	228.16 ns	0.16 ns	0.57 *	541.50 **	732.83**	2.66 ns
Location(L)	2	0.59 **	0.0006 **	1.89 ns	1.29 ns	27.13 **	0.30 ns	0.38 ns	0.45 *	1815.04 *	0.20 *	1.04 **	327.16 **	676.07**	310.04 ns
Interaction															
(S*L)	2	0.06 ns	0.0001 ns	2.17 *	4.42 ns	0.30 ns	0.09 ns	1.17 ns	0.46 ns	429.54 ns	0.07 ns	1.55 **	31.50 ns	195.44 ns	1715.79 **
Error	15	0.08	0.0001	0.54	1.21	2.10	0.13	1.81	0.14	445.58	0.07	0.12	32.90	74.33	234.98
Total	23	---	---	---	---	---	---	---	---	---	---	---	---	---	---
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.															

The mean performance of some fiber properties for cotton variety Giza 86 as affected by growing seasons, growing locations and their interactions were shown in Table (3).

1.2.1 Fiber Length Measurement:

For each of the Upper half mean lengths, Fiber uniformity didn't give any significant differences between the two seasons whereas short fiber index season 2018 gave the highest value (6.10%) Compared with Season 2019 as shown in Table (3).

Respecting the effect of location, Fiber length and short fiber index differed significantly as affected by location where Location 3 El-Garbeia gave the highest UHML (33.12 mm) as well as location 2 EL-Munofeya revealed the maximum value (6.36%) of short fiber index.

Fiber uniformity was affected by locations the differences did not reach to significant level.

1.2.2 Micronair Reading and Maturity Index:

Season 2018 gave the highest value for the micronair reading (4.24) and the Maturity index value (0.86) Compared with Season 2019 as shown in Table (3).

Respecting the effect of location where Location 2 EL- Munofeya gave the highest micronair reading value (4.42) and Maturity index (0.87) in Contrast with Location 3 El-Garbeia obtained the Lowest value for the two traits.

1.2.3 Fiber Strength and Fiber Elongation:

Season 2019 gave the highest value for the fiber strength value (42.65 g/tex) and the fiber elongation value (6.27%) compared with season (2018) as shown in Table (3).

Concerning the growing locations effect, location1 EL- Beheira recorded the highest fiber strength value (43.81) while the fiber elongation did not show any significant differences.

Table 3: Mean performance of some fiber properties for the cotton variety GIZA 86 as affected by growing season (S), Location(L) and their interactions.

Entries		Micronair reading	Maturity index	Fiber Length (U.H.M.L.)	Fiber Uniformity	Fiber Strength	Fiber Elong.	Reflectance degree (Rd)	Yellowness degree (+b)	Trash count	Trash area	Short fiber index	Hair weight	spinning consistency index	Neps count
				(mm)	(%)	(g/ Tex)	(%)	(%)	(%)			(%)	(mg)	(SCI)	(/m)
SEASON (S)															
Season 2018		4.24a	0.867a	32.68a	86.09a	40.71b	5.60b	75.31a	9.09a	49.66a	0.67a	6.10a	162.66a	187.41b	88.25a
Season 2019		3.97b	0.860b	32.88a	86.75a	42.65a	6.27a	74.69a	8.47b	43.50a	0.51a	5.79b	153.16b	198.46a	87.58a
L.S.D AT 0.05		0.24	0.006	ns	ns	1.26	0.3	Ns	0.32	ns	ns	0.3	4.99	7.5	ns
LOCATION (L)															
EL-Beheira(L1)		3.97b	0.86b	33.01a	86.70a	43.81a	5.83a	74.97a	8.51b	62.37a	0.75a	5.72 b	158.50a	202.02a	82.12a
EL-Munofeya(L2)		4.42a	0.87a	32.22a	85.96a	40.55b	5.81a	75.23a	8.96a	32.37b	0.42b	6.36a	164.00a	183.64b	87.12a
El-Garbeia(L3)		3.93b	0.85b	33.12a	86.61a	40.70b	6.16a	74.80a	8.87ab	45ab	0.60ab	5.75b	151.25b	193.13a	94.50a
L.S.D AT 0.05		0.296	0.008	ns	ns	1.545	ns	Ns	0.396	22.496	0.283	0.3742	6.112	9.188	ns
INTERACTION															
(S*L)		ns	ns	*	ns	ns	ns	ns	ns	ns	ns	**	ns	ns	**

Means within each column with the same letter are not significant differences at 0.05 level of probability.

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.

1.2.4 Fiber Color and Trash:

Color Attributes:

As shown in Table (3) it is clear that the mean value of the reflectance degree (Rd) did not differ any significant differences for the two growing seasons (2018) and (2019) while the growing season (2018) gave the highest yellowness degree (+b) value (9.09%).

Respecting the effect of the growing locations, the yellowness degree (+b) differed significantly as affected by growing locations where location L2 (EL- Munofeya) gave the highest value (8.96%) meanwhile the reflectance degree (Rd.) was affected by growing locations did not reach to the highest significant level, as presented in Table (3).

Trash Attributes:

Presented in Table (3) reflected that each trash count and trash area did not differ significantly for the two growing seasons (2018) and (2019).

Concerning the effect of the growing locations, the traits trash count and trash area differed significantly, where location 2 El-Munofeya gave the lowest trash count value (32.37) and also for the trash area revealed (0.42) as shown in Table (3).

Fiber neps Count:

It is obvious that the neps count did not differ significantly for the two growing seasons (2018) and (2019) as presented in Table (3).

Respecting the effect of the growing locations, the neps count did not differ significantly between the three growing locations as shown in Table (3).

1.2.5 Hair Weight:

It is obvious in Table (3) that the hair weight trait differed significantly as affected by the growing season factor as well as season (2018) gave the highest value (162.66 mg) in contrast with season (2019).

Respecting the effect of location, the hair weight differed significantly as affected by the growing locations where L2 (EL- Munofeya) gave the highest value (164.00mg).

1.2.6 Spinning Consistency Index (SCI):

Regarding Table (3), it is obvious that this trait differed significantly as affected by the growing seasons factor as well as season (2019) gave the highest value (198.46) compared with season (2018).

Concerning the effect of growing location Spinning consistency index (SCI) differed significantly as affected by location where location 1 (EL- Beheira) gave the highest (SCI) Value (202.02).

These results were in harmony with those, Mohamed *et al.* (2003), Hassan *et al.* (2012), Idris (2012) and Aly El-Banna (2019) who found that three growing locations of cotton varieties Kafr El-Dawar, Kafr El-Sheikh, and Basion affected significantly for seven fiber properties of cotton variety Giza 86.

On the contrary insignificant differences were affected by cotton cultivation location for five fiber properties i.e., UHML, uniformity, short fiber index, maturity and micronair reading.

1.3 The Interaction Between Growing Seasons(S) and Growing Locations(L) (SxL) for the Long Staple Egyptian Cotton Variety Giza 86 during (2018) and (2019) Growing Seasons.

It is clear that the growing location (L3) El-Garbeya in 2018 growing season verified the highest value of the two traits, fiber length (U.H.M.L.) was (33.51m.m) and neps count was (108.50%) while it recorded the lowest value (5.52%) of short fiber index. The location (L3) El- ElBeheira in 2018 growing season recorded the lowest value of neps count (67.00/m).

The location (L2) El-Munofeya location (L2) in 2018 season recorded the lowest fiber length (U.H.M.L.) value (31.58 m.m) meanwhile, it recorded the highest value (7.00%) for the short fiber index, as shown in Table (4).

These results were in harmony with those of, Mohamed *et al.* (2003), Hassan *et al.* (2012), and Idris (2012).

Table 4: The interaction between growing season(S) and growing location(L) (S*L) for the cotton variety Giza 86 fiber properties.

Season (S)	Location (L)	Fiber Length (U.H.M.L.) (mm)	Short fiber index (%)	Neps count (/m)
2018	EL-Beheira (L1)	32.96a	5.77b	**67.00c**
	EL-Munofeya (L2)	**31.58b**	**7.00a**	89.25abc
	El-Garbeia (L3)	**33.51a**	**5.52b**	**108.50a**
2019	EL-Beheira (L1)	33.06a	5.67b	97.25ab
	EL-Munofeya(L2)	32.87a	5.72b	85.00bc
	El-Garbeia(L3)	32.72a	5.97b	80.50bc
L.S.D AT 0.05		1.105	0.529	23.10

2 The Second Cotton Variety Giza 94:

2.1 The Mean Square of Cotton Giza 94 Variety as Affected by Growing Season, Location and Their Interactions:

Presented data in Table (5) showed that significant differences or highly significant mean squares were obtained between seasons for micronaire reading, maturity index, upper half mean length (U.H.M.L), fiber strength, fiber elongation, short fiber index, and spinning constant index.

The significance of the mean square for cultivation location is only the fiber length (U.H.M.L) character as Presented in Table (5).

The significance of mean square for growing seasons and growing locations is due to differences in the growing season from one season to another as well as Governorate variance to another.

Table 5: Mean squares of some fiber properties of the cotton variety GIZA 94 as affected by growing season(S), Location(L) and their interactions during seasons 2018 and 2019.

S.O.V	d.f	Micronair reading	Maturity index	Fiber Length (U.H.M.L)	Fiber Uniformity	Fiber Strength	Fiber Elong.	Reflectance degree (Rd)	Yellowness degree (+b)	Trash count	Trash area	Short fiber index	Hair waight	spinning consistency index	Neps count
Blocks	3	0.03	0.0001	0.12	3.55	1.53	0.23	0.19	0.49	60.5	0.1	0.01	19.61	87.17	188.48
Season(S)	1	0.25 *	0.0010 **	7.09 **	1.45 ns	18.20 **	10.53 **	0.96 ns	0.18 ns	1014.00 ns	0.029 ns	0.240 **	24.00 ns	738.59 **	92.04 ns
Locatio (L)	2	0.02 ns	0.0001 ns	0.79 *	0.31 ns	1.33 ns	0.07 ns	2.18 ns	0.16 ns	322.16 ns	0.02 ns	0.007 ns	26.54 ns	4.18 ns	196.29 ns
Interaction															
(S*L)	2	0.01 ns	0.0002 ns	0.36 ns	1.58 ns	1.46 ns	1.28 *	0.80 ns	0.04 ns	684.50 ns	0.17 ns	0.02 ns	0.37 ns	57.92 ns	606.54 ns
Error	15	0.04	0.0001	0.2	0.88	1.67	0.27	1.08	0.15	269	0.05	0.02	15.54	40.21	408.85
Total	23	---	---	---	---	---	---	---	---	---	---	---	---	---	---

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.

On the other side, fiber elongation revealed significant differences in the interaction between growing seasons and growing locations, while the rest of the fiber properties did not show any significant differences as shown in Table (5).

These results were in the same trend as the researchers Idris (2012) who found the mean square of cotton varieties for all studied fiber properties were highly significant differences as well as the two growing seasons as well as Mohamed *et al.* (2003), Hassan *et al.* (2012), Idris (2012) El-Banna (2019), Lingaiah *et al.* (2020), Nassar *et al.* (2021) and Zaheer *et al.* (2021).

2.2. The Mean Performance of Some Fiber Properties for Cotton Variety Giza 94 as Affected by Growing Season, Locations and Their Interactions:

2.2.1 Fiber Length Measurement:

Fiber uniformity didn't give any significant differences between the two seasons whereas fiber length (U.H.M.L) and short fiber index season 2018 gave the highest value (34.28 mm) for the fiber length (U.H.M.L) and (5.68%) for the short fiber index, Compared with season 2019.

Respecting the effect of location, fiber length (U.H.M.L) differed significantly as affected by location whereas Location 2 El-Dakahlia gave the highest UHML value. (33.98 mm) as well as location 1 Kafr El-Sheikh as affected by locations recorded the lowest fiber length (U.H.M.L) value (33.38m.m) while the fiber uniformity and the short fiber index differences did not reach to significant level as shown in Table (6).

2.2.2 Micronair Reading and Maturity:

Season 2018 gave the highest value for the micionair reading (4.05) and the Maturity index (0.86) Compared with season 2019 as shown in Table (6).

Respecting the effect of location the differences did not reach any significant level.

2.2.3 Fiber Strength And Fiber Elongation:

Season 2019 gave the highest value fiber elongation value (6.98%) compared with season (2018) meanwhile the fiber strength didn't give any significant differences as shown in Table (6).

Concerning the effect of growing location the differences did not reach to any significant level.

Table 6: Mean performance of some fiber properties for the cotton variety Giza 94 as affected by growing season (S), Location(L) and their interactions.

Entries	Micronair reading	Maturity index	Fiber Length (U.H.M.L.)	Fiber Uniformity	Fiber Strength	Fiber Elong.	Reflectance degree (Rd)	Yellowness degree (+b)	Trash count	Trash area	Short fiber index	Hair weight	spinning consistency index	Neps count
			(mm)	(%)	(g/Tex)	(%)	(%)	(%)			(%)	(mg)	(SCI)	(/m)
SEASON (S)														
Season 2018	4.05a	0.86a	34.28a	86.63a	39.23b	5.65b	77.08a	8.95a	32.08a	0.55a	5.68a	153.41a	189.57b	89.83a
Season 2019	3.84b	0.84b	33.20b	87.12a	40.97a	6.98a	76.68a	8.78a	45.08a	0.62a	5.48b	151.41a	200.66a	93.75a
L.S.D AT 0.05	0.17	0.006	0.39	ns	1.38	0.46	ns	ns	ns	ns	0.13	ns	5.51	ns
LOCATION (L)														
Kafr El-Sheikh(L1)	3.95a	0.85a	33.38b	87.00a	39.86a	6.37a	77.26a	8.72a	40.50a	0.58a	5.58a	150.37a	194.43a	88.62a
El-Dakahleya(L2)	4.00a	0.85a	33.98a	86.98a	39.87a	6.21a	77.10a	8.87a	31.50a	0.53a	5.55a	153.00a	195.04a	88.62a
El- Sharkeya(L3)	3.88a	0.85a	33.86ab	86.65a	40.57a	6.37a	76.28a	9.01a	43.75a	0.63a	5.61a	153.87a	195.87a	89.25a
L.S.D AT 0.05	ns	ns	0.48	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
INTERACTION														
(S*L)	ns	ns	ns	ns	ns	*	ns	ns	ns	ns	ns	ns	ns	ns

Means within each column with the same letter are not significant differences at 0.05 level of probability.
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.

2.2.4 Fiber Color and Trash:

Color Attributes: As shown in Table (6), it is clear that the mean value of the reflectance degree (Rd) and yellowness degree (+b) did not differ significantly for the two seasons (2018) and (2019).

Respecting the effect of growing locations, reflectance degree (rd) and yellowness degree (+b) the differences did not reach the highest significant level, as presented in Table (6).

Trash Attributes: As presented in Table (6) reflected that each trash count and trash area did not show significant differences for the two seasons (2018) and (2019).

Concerning the effect of location, trash count and Trash area did not differ any significant differences.

Fiber neps Count: It is obvious that the neps count did not differ significantly for the two seasons (2018) and (2019) as presented in Table (6).

Respecting the effect of location, neps count did not show any significant differences between the three locations as shown in Table (6).

2.2.5 Hair Weight: It is obvious in Table (6), that the hair weight did not differ significantly between the two seasons (2018) and (2019) also the location effect did not differ significantly between the three growing locations.

2.2.6 Spinning Consistency Index (SCI): Table (6) (SCI) did not differ significantly for the two seasons (2018) and (2019) also the location effect did not differ significantly between the three locations.

These findings align with the results reported by Rahouma *et al.* (2008), Dana Jawdat *et al.* (2012), indicating stability in specific fiber traits such as micronaire reading, fiber length, and strength, which were genotype-specific. Notably, fiber elongation remained unaffected by cultivation practices and environmental conditions, implying robust genetic foundations governing this trait. Similarly, studies by Hassan *et al.* (2012), Shaker (2013), and Riham *et al.* (2015) emphasized that the impact of genotypes and environmental conditions varied from one environment to another.

2.3 The Interaction Between Growing Season(S) and Location(L) (SxL) for the Long Staple Egyptian Cotton Variety Giza 94 during 2018 and 2019 Seasons:

It is clear that the growing location (L3) El- El-Sharkeya in the 2019 growing season verified the highest value of fiber elongation (7.25%) while location (L2) El-Dakahleya in 2018 growing season recorded the lowest fiber elongation value (5.30).

Several works studiedthe traits performance of cotton genotypes under different environments i.e. Killi and Harem (2006) Satish *et al*. (2009), Dewdar (2013) and Navdeep. *et al*. (2016).

Table 7: The interaction between season(S) and location(L) (S*L) for the cotton variety Giza 94 fiber properties.

Season (S)	Location (L)	Fiber Elongation (%)
Season 2018	Kafr El-Sheikh (L1)	6.17bc
	El-Dakahleya (L2)	5.30d
	El- Sharkeya (L3)	5.50cd
Season 2019	Kafr El-Sheikh (L1)	6.57ab
	El-Dakahleya (L2)	7.12a
	El- Sharkeya (L3)	7.25a
L.S.D AT 0.05		0.79

3 The Third Cotton Variety Giza 95:

3.1 The Mean Square of Cotton Variety Giza 95 as Affected by Growing Season, Location and Their Interactions (Table 8).

It was clear that significant differences or highly significant mean squares were obtained between growing seasons for maturity index, short fiber index, and neps count.

The same trend was found for cultivation location for the next fiber properties: maturity, fiber uniformity and fiber elongation. The significance of mean square for seasons and locations is due to differences in the growing season from one season to another as well as Governorate variance to another. On the other side, micronaire reading, maturity index, fiber elongation, yellowness degree (+b) and hair weight revealed significant differences in the First order interaction between growing seasons and growing locations.

These findings align with those studied by Hassan *et al.* (2005), Rahoumah *et al.* (2008), Shaker (2013) and El-Seidy *et al*. (2017). In their report, they noted that the influence of environmental conditions varied from one location to another and from one season to another.

Table 8: Mean squares of some fiber properties of the cotton variety Giza 95 as affected by growing season(S), Location(L) and their interactions during seasons 2018 and 2019.

S.O.V	d.f	Micronair reading	Maturity index	Fiber Length (UHML)	Fiber Uniformity	Fiber Strength	Fiber Elong.	Reflectance degree (Rd)	Yellowness degree (+b)	Trash count	Trash area	Short fiber index	Hair waight	spinning consistency index	Neps count
Blocks	3	0.17	0.0002	0.02	0.56	2.02	0.23	1.31	0.13	1370.26	0.15	0.37	101.16	23.29	479.15
SEASON	1	0.37 ns	0.0004 *	0.83 ns	3.45 ns	0.42 ns	0.15 ns	0.92 ns	0.51 ns	0.04 ns	0.060 ns	7.82 **	88.16 ns	182.60 ns	2926.04 **
LOCATION (L)	2	0.28 ns	0.0002 *	0.40 ns	5.95 *	1.90 ns	1.17 *	2.57 ns	0.36 ns	803.16 ns	0.060 ns	0.10 ns	106.62 ns	25.26 ns	1057.87 ns
Interaction															
(S*L)	2	0.40 *	0.0008**	0.03 ns	1.84 ns	4.90 ns	2.34 **	2.73 ns	0.50 *	631.16 ns	0.006 ns	0.89 ns	172.04 *	252.74 ns	254.04 ns
Error	15	0.08	0.0001	0.32	1.47	2.47	0.19	2.13	0.11	442.69	0.072	0.34	43.56	92.36	293.01
Total	23	---	---	---	---	---	---	---	---	---	---	---	---	---	---

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.

3.2. The Mean Performance of Some Fiber Properties for Cotton Variety Giza 95 as Affected by Growing Season, Locations and Their Interactions:

3.2.1 Fiber Length Measurement:

Each of the Upper half mean length and fiber uniformity didn't show any significant differences between the two seasons. Respecting the effect of location where Location 2 EL-Fayoum gave the highest fiber uniformity value (83.83%) in contrast Location 1 Beni suef recorded the Lowest fiber uniformity value (82.22) shown in Table (9).

3.2.2 Micronair Reading and Maturity Index:

Season 2018 gave the highest maturity index value (0.86), Season 2019 gave the lowest maturity index value (0.85) while the micronair reading didn't show any significant differences between the two seasons. as shown in Table (9).

Respecting the effect of the growing location where Location 2 EL- Fayoum gave the highest micronair reading value (4.31) and Maturity index (0.86) in Contrast with the growing Location 3 El-Menya recorded the Lowest value of the two characters.

3.2.3 Fiber strength and fiber elongation:

Each fiber strength and fiber elongation didn't give any significant differences between the two growing seasons. as shown in Table (9).

Respecting the effect of location where Location 1 Beni Suef gave the highest fiber elongation value (7.02%) in Contrast with Location 2 EL- Fayoum recorded the Lowest fiber elongation value (6.31), while fiber strength didn't give any significant differences relating to Table (9).

3.2.4 Fiber Color and Trash:

Color attributes: As shown in Table (9) it is clear that the mean value of the reflectance degree (Rd) and yellowness degree (+b) did not differ significantly between the two seasons (2018) and (2019).

Respecting the effect of location, where Location 1 Beni Suef gave the highest yellowness degree (+b) value (12.07) in contrast the reflectance degree (Rd) differences did not reach the highest significant level, as presented in Table (9).

Trash Attributes: Table (9), reflected that each trash count and trash area did not differ significantly during the 2018 and 2019 seasons**.** Concerning the effect of location, trash count and Trash area there were no significant differences**.**

Fiber neps Count: It is obvious that season 2019 gave the highest neps count value (93.16) while season (2018) recorded the lowest neps count value (71.08) as presented in Table (9).

Respecting the effect of location, where Location did not differ any significant differences offered in Table (9).

3.2.5 Hair Weight: Data in Table (12), that the hair weight did not differ significantly for the two seasons (2018) and (2019).

Respecting the effect of location, the hair weight did not differ any significant differences.

3.2.6 Spinning Consistency Index (SCI):

Regarding Table (9) (SCI) did not differ significantly for the two seasons (2018) and (2019) also the location effect did not differ significantly between the three locations.

Table 9: Mean performance of some fiber properties for the cotton variety Giza 95 as affected by growing season (S), Location(L) and their interactions.

Entries	Micronair reading	Maturity index	Fiber Length (U.H.M.L.)	Fiber Uniformity	Fiber Strength	Fiber Elong.	Reflectance degree (Rd)	Yellowness degree (+b)	Trash count	Trash area	Short fiber index	Hair weight	spinning consistency index	Neps count
			(mm)	(%)	(g/ Tex)	(%)	(%)	(%)			(%)	(mg)	(SCI)	(/m)
SEASON (S)														
Season 2018	4.23a	0.86a	28.71a	82.47a	35.73a	6.50a	68.58a	11.97a	52.41a	0.53a	8.87a	153.16a	144.89a	71.08b
Season 2019	3.98a	0.85b	29.09a	83.23a	35.46a	6.66a	68.19a	11.68a	52.50a	0.63a	7.73b	149.33a	150.41a	93.16a
L.S.D AT 0.05	ns	0.006	ns	ns	ns	ns	ns	ns	ns	ns	0.513	ns	ns	14.89
LOCATION (L)														
Beni suef (L1)	3.93b	0.85b	28.82a	82.22b	35.86a	7.02a	68.20a	12.07a	63.87a	0.68a	8.37a	151.75ab	144.89a	94.2a
El-Fayoum (L2)	4.31a	0.86a	29.16a	83.83a	35.03a	6.31b	69.02a	11.71ab	48.37a	0.58a	8.36a	154.62a	149.68a	71.37b
El-Menya (L3)	4.08ab	0.85ab	28.73a	82.50b	35.90a	6.42b	67.93a	11.70b	45.12a	0.49a	8.17a	147.37b	146.37a	80.75ab
L.S.D AT 0.05	0.3	0.008	ns	1.29	ns	0.47	ns	0.36	ns	ns	ns	7.03	ns	18.24
INTERACTION														
(S*L)	*	**	ns	ns	ns	**	ns	*	ns	ns	ns	*	ns	ns

Means within each column with the same letter are not significant differences at 0.05 level of probability.
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

3.3 The Interaction Between Growing Season(S) and Location(L) (SxL) for The Long Staple Egyptian Cotton Variety Giza 95 during (2018) and (2019) Growing Seasons.

It is clear that growing location (L1) Beni Suef in 2019 growing season recorded the highest fiber elongation value (7.32%), meanwhile, it recorded the lowest micronair reading value (3.62).

The growing location (L1) Beni Suef in 2018 growing season obtained the highest yellowness degree (+b) value (12.47%) and the highest hair weight value (157.75).

The growing location (L2) El-Fayoum in 2019 growing season verified the highest value of the 2 characters, micronair reading(4.43) and Maturity index(0.87) whereas recorded the lowest fiber elongation value (5.77%) as presented in Table (10).

The growing location (L1) Beni Suef in 2019 growing season recorded the lowest maturity index value (0.84), also the lowest micronair reading(3.62) during the same growing season.While El-Menya Governorate recorded the lowest value for the trait hair grain weigh (144.2 mg) for the Giza 95 variety during the growing season of 2018.

Several works studiedthe traits performance of cotton genotypes under different environments i.e. Killi and Harem (2006) Satish *et al*. (2009), Dewdar (2013) and Navdeep. *et al.* (2016). These findings corroborate those discussed by Hassan *et al.* (2005), Rahoumah *et al.* (2008), Shaker *et al.* (2013), and El-Seidy *et al*. (2017). who noted that the impact of environmental conditions varied from one location and season to another.

Table 10: The interaction between growing season(S) and location(L) (S*L) for the cotton variety Giza 95 fiber properties.

Season (S)	Location (L)	Micronair reading	Maturity index	Fiber Elongation	Yellowness degree (+b)	Hair weight
				(%)	(%)	(mg)
2018	**Beni suef (L1)**	4.24ab	0.86ab	6.72a	12.47a	157.75a
	El-Fayoum (L2)	4.18ab	0.85bc	6.85a	11.85b	157.50a
	El-Menya (L3)	4.28ab	0.87a	5.95ba	11.60b	144.25b
2019	**Beni suef (L1)**	3.62c	0.84d	7.32a	11.67b	145.75b
	El-Fayoum (L2)	4.43a	0.87a	5.77b	11.57b	151.75ab
	El-Menya (L3)	3.89bc	0.84cd	6.90a	11.80b	150.50ab
L.S.D at 0.05		0.43	0.01	0.67	0.51	9.94

Recommendations:

Based on the study results, clear effects of growing seasons and growing locations on the properties of cotton varieties were observed. Significant differences were found in variables such as strength, elongation, yellowness degree, hair weight, and spinning consistency index (SCI). for Giza 86, along with other properties for Giza 94 and Giza 95. The results highlight the specific interaction between season and location that affects certain

properties. This emphasizes the importance of studying this interaction to achieve better cotton variety performance.

The results of this study offer crucial insights for enhancing the management of cotton cultivation. They underscore the significance of investigating the interplay between climatic and environmental factors to achieve optimal performance for cotton varieties. It is advisable to persist in the comprehensive evaluation of cotton varieties across diverse conditions and environments, spanning multiple seasons and locations, prior to formulating recommendations regarding the selection and utilization of specific varieties in designated locations.

In conclusion, this research underscores the significance of integrating seasonal and location variables in analysing the performance of cotton plant varieties.

Declarations:

Ethical Approval: Ethical Approval is not applicable.

Competing interests: The authors declare no conflict of interest.

Authors Contributions: I hereby verify that all authors mentioned on the title page have made substantial contributions to the conception and design of the study, have thoroughly reviewed the manuscript, confirm the accuracy and authenticity of the data and its interpretation, and consent to its submission.

Funding: No funding was received.

Availability of Data and Materials: All datasets analysed and described during the present study are available from the corresponding author upon reasonable request.

Acknowledgements: We appreciate the efforts of Dr. Xiao-Lin Chen and his lab team especially Xuan Cai at Huazhong Agricultural University, Wuhan, China, for providing the strain which we use in this work.

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ARABIC SUMMARY

تأثير اماكن الزراعة على الخواص التكنولوجية لبعض اصناف القطن المصرى

محمد أحمد عبد الجواد نصار[1] و إبراهيم عباس السيد[1] و علي أحمد علي الصاوى البنا[1] و مي على ياقوت [2]

1- قسم الأنتاج النباتى -كلية الزراعة- سابا باشا -جامعة الأسكندريه.

2- الهيئة العامة للتحكيم وإختبارات القطن – الأسكندرية.

أجري هذا البحث بقسم الانتاج النباتى فى كلية الزراعة (سابا باشا)- جامعة الأسكندرية - مصر, وفى مختبرات الهيئة العامة للتحكيم و اختبارات القطن (CATGO) الخاضعة لوزارة التجارة و الصناعه على بعض اصناف القطن المصرى والتى تنتمى الى فئة القطن طويل التيله و هى جيزه ٨٦ , جيزه ٩٤ و جيزه ٩٥ خلال موسمي الصيف المتتاليين (٢٠١٩/٢٠١٨) و (٢٠٢٠/٢٠١٩).

تم استخدام لهذه الدراسة ثلاثة اصناف للقطن المصري التجارية ينتميان الى مجموعة الأقطان *Gossypium barbadense*, المأخوذة من التقسيم الإقليمي لأصناف القطن المنزرعة، حيث تمت الزراعه في ٩ اماكن انتاج في مصر الصنف جيزه 86 المنزرع فى (البحيرة ، المنوفية ، الغربية) و الصنف جيزة 94 المنزرع فى (كفرالشيخ ، الدقهليه , الشرقية) وأخيرا الصنف جيزة 95 المنزرع فى (بني سويف , الفيوم , المنيا) في موسمين متتاليين. (٢٠١٨و ٢٠١٩). تم استخدام تصميم القطاعات العشوائيه الكاملة باربع مكررات في كل موقع.

وكانت أهداف الدراسة :

1- العوامل المؤثره على خصائص اصناف القطن محل الدراسة.

2- تقييم كيفية تأثير موسم النمو و موقع الزراعه و تفاعلاتها بشكل جماعى فى الإختلافات الملحوظه فى خصائص الألياف.

3- تحديد كيفية تكيف الأصناف محل الدراسة و الحفاظ على جودتها فى ظروف بيئية مختلفه.

4- تحليل تأثير التداخل بين مواسم الزراعه ومواقع الزراعة على الأصناف محل الدراسة.

النتائج:

- اختلفت المواسم الزراعية 2018 و2019 اختلافا معنويا او عالى المعنوية فى صفات جيزة 86 ل قراءة الميكرونير, معامل النضج, متانة الألياف, استطالة الألياف و درجة الاصفرارو معامل الشعيرات القصيرة , وزن خصلة الشعيرات ب الملجرام و ثابت الغزل .

- سجلت المواقع الزراعية المحافظات الثلاثة (البحيرة L1, المنوفيةL2 ,الغربية L3) اختلافات معنوية أو عالية المعنوية فى 9 صفات للصنف جيزة 86 و هى : قراءة الميكرونير , معامل النضج, متانة الألياف ,درجة الاصفرار, عدد الشوائب,مساحة الشوائب, معامل الشعيرات القصيرة , وزن الشعيرات بالملليجرام ,ثابت الغزل .

- أظهر التفاعل بين عاملى الدراسة المواسم الزراعية و المواقع اختلافا معنويا فى طول الشعيرات و عالى المعنوية و عالى المعنوية فى معامل الشعيرات القصيرة و عدد العقد / متر بينما لم تسجل باقى الصفات اى اختلافات معنوية .

- سجل الصنف جيزة 86 افضل القيم موسم 2018 لصفة قراءة الميكرونير (4.24) , متانة الشعيرات (0.86) , و اصفرار الشعيرات (9.09%) , معامل الشعيرات القصيرة (6.10) و وزن الشعيرات (162.66 /م) بينما كان أفضل المواقع الزراعية محافظة المنوفية لصفة قراءة الميكرونير (4.42),معامل النضج (0.87) , اعلى درجة اصفرار (8.96 %), عدد الشوائب (32.37), مساحة الشوائب (0.42), وزن الشعيرات (164 ملليجرام) بينما حققت محافظة البحيرة L1 فى الصفات قراءة الميكرونير (3.97),تفوقف فى صفة متانة الألياف (43.81 مم/تكس) , اعطت درجة الأصفرار (8.51),واقل معامل الشعيرات القصيرة (5.72) , اعلى ثابت غزل (202.02)و عدد العقد(82.12 /متر).

- و على الجانب الأخر اظهرت محافظة الغربية (L3) أفضل القيم فى الصفات قراءة الميكرونير (3.93), طول الشعيرات (33.12 مم) و استطالة الالياف (6.16).
- وسجل التفاعل بين عاملى الدراسة المواسم الزراعية و المواقع اعلى القيم بمحافظة الغربية L3 للموسم الزراعى 2018 للصنف جيزة 86 لصفتى طول الشعيرات (33.51 مم)و صفة عدد العقد(108.50 /م) بينما سجلت محافظة المنوفية L2 بنفس الموسم الزراعى أعلى معامل للشعيرات القصيرة (7.00%).
- اختلفت المواسم الزراعية 2018 و2019 اختلافا معنويا او عالى المعنوية فى صفات جيزة 94 ل قراءة الميكرونير, معامل النضج, طول الشعيرات, متانة الألياف, استطالة الألياف , معامل الشعيرات القصيرة , و ثابت الغزل .
- سجلت المواقع الزراعية المحافظات الثلاثة (كفر الشيخ L1, الدقهلية L2 ,الشرقية L3) اختلافات معنوية أو عالية المعنوية فى صفة واحدة فقط للصنف جيزة 94 و هى طول الشعيرات بينما لم تسجل باقى الصفات اى اختلافات معنوية
- أظهر التفاعل بين عاملى الدراسة المواسم الزراعية و المواقع اختلافا معنويا لصفة طول الشعيرات بينما لم تسجل باقى الصفات اى اختلافات معنوية .
- سجل الصنف جيزة 94 افضل القيم موسم 2018 لصفة قراءة الميكرونير (4.05) ,نضج الشعيرات (0.86), طول الشعيرات (34.28 مم) , معامل الشعيرات القصيرة (5.68%) و افضل القيم لموسم 2019 لصفات متانة الشعيرات (40.97 جم/تكس) , استطالة الشعيرات (6.98%) و صفة ثابت معامل الغزل (200.66) بينما كان أفضل المواقع الزراعية محافظة الدقهلية L2 لصفة طول الشعيرات (33.98 مم) .
- وسجل التفاعل بين عاملى الدراسة المواسم الزراعية و المواقع اعلى القيم بمحافظة الشرقية للموسم الزراعى 2019 للصنف جيزة 94 لصفة استطالة الشعيرات (7.25%).
- اختلفت المواسم الزراعية 2018 و2019 اختلافا معنويا او عالى المعنوية فى صفات جيزة 95 ل معامل النضج, معامل الشعيرات القصيرة , و عدد العقد .
- سجلت المواقع الزراعية المحافظات الثلاثة (بنى سويف L1, الفيوم L2 ,المنيا L3) اختلافات معنوية فى الصفات للصنف جيزة 95 و هى نضج الشعيرات ,انتظامية الطول, استطالة الشعيرات بينما لم تسجل باقى الصفات اى اختلافات معنوية
- أظهر التفاعل بين عاملى الدراسة المواسم الزراعية و المواقع اختلافا معنويا و عالى المعنوية لصفة الميكرونير ,نضج الشعيرات ,استطالة الشعيرات, درجة الاصفرارو وزن الشعيرات بالمليجرام بينما لم تسجل باقى الصفات اى اختلافات معنوية .
- سجل الصنف جيزة 95 افضل القيم موسم 2018 لصفة نضج الشعيرات (0.86) , معامل الشعيرات القصيرة (8.87%) و افضل القيم لموسم 2019 لصفات عدد العقد(93.16/م) بينما كان أفضل المواقع الزراعية محافظة الفيوم L2 لصفة قراءة الميكرونير (4.31) , نضج الشعيرات (0.86), و انتظامية الطول (83.83 %) , وزن الشعيرات (154.62 مللى جرام) بينما سجلت محافظة بنى سويف L1 اعلى القيم لصفة استطالة الشعيرات (7.02%), درجة الاصفرار (12.07%) و صفة عدد العقد (94.2/م).
- سجل التفاعل بين عاملى الدراسة المواسم الزراعية و المواقع اعلى القيم بمحافظة بنى سويف L1 للموسم الزراعى 2018 للصنف جيزة 95 لصفتى درجة الاصفرار (12.47%), وزن الشعيرات (157.75 مللى جرام) بينما للموسم الزراعى 2019لنفس المحافظة اعلى قيمة لصفة استطالة الشعيرات (7.32%)فى حين تسجيلها لأقل قراءه لصفتى قراءة الميكرونير (3.62) و نسبة نضج الشعيرات (0.84), سجلت محافظة الفيوم L2 للموسم الزراعى 2019 للصنف جيزة 95 اعلى القيم لصفتى قراءة الميكرونير (4.43), نضج الشعيرات (0.87) و سجلت نفس المحافظه أقل قيمة لصفتى استطالة الشعيرات (5.77%)و ايضا اقل قيمة لدرجة الأصفرار (11.57%), بينما سجلت محافظة المنيا L3 للموسم الزراعى 2018 للصنف جيزة 95 اقل القيم لصفة وزن الشعيرات (144.25%).