

EFFECT OF LINT GRADES ON SOME PHYSICAL AND STRUCTURAL FIBER PROPERTIES IN EGYPTIAN COTTONS.

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ABSTRACT: This research was carried out at Grade Res. Dep. Cotton Research Institute, Agric. Res. Center during 2002 season to study the relations between some physical and structural characters for three cotton cultivars. One of them represented Extra- long staple category i.e. Giza 88, whereas the others represented Long staple category i.e. Giza 86 and Giza 90. Two main grades F.G. and F.G.F. and two grade steps G./ F.G. and G.F./ F.G.F. were chosen during this investigation. The results indicated that Giza 88 ranked first in fiber length at 2.5% S.L., micronaire value, fiber strength and stiffness. With respect to the tested grades, fully good (F.G.) and Good /fully good possessed the longest, the strongest and best toughness. Number of convolutions and reversals differed according to tested varieties. Number of reversals were increased in the low grades, while convolutions number did not follow a conspicuous trend.

INTRODUCTION

It is well known that. Egyptian cotton varieties are characterized by several excellent fiber properties such as length, fineness, brightness and strength. This remarkable superiority may be ought to the positive relationships between physical and structural parameters that reflect on fiber quality. According to the difference between fiber characters and quality, cotton fiber was classified into several grades and grade steps that play an important role in the evaluation of the final product, as the side of price and the side of spinning value. Hegab *et al.* (1986) found that the higher grades were longer, stronger, more mature and higher weight than lower grades. Kamal *et al.*, (1995) reported that there is positive and significant correlation between 2.5 % span length, length uniformity and both of lint cotton grades and yarn appearance grade. On

the other hand, many of fiber properties such as strength, stiffness, toughness and elongation are affected by number of reversals and convolutions. In this respect Nafisa (1973), detected negative relationship between the number of structural reversals and fiber strength in the Egyptian cotton varieties. Ghorab *et al.*, (1994), indicated that, reversals in cotton fiber are weak points and adversely affect tensile strength. Seif *et al.* (1994) reported that the convolutions number/cm showed highly significant positive correlation with tensile strength measurements.

The objective of this research is to study or expose the differences between the high grades and low ones and its effect on some physical structural fiber properties, as well as to study the relationships between lint grades and these fiber properties and the interrelationships between fiber physical, mechanical and structural properties as well.

MATERIALS AND METHODS

This investigation was conducted at Cotton Res. Inst. Agric. Research Center, Giza, Egypt, during 2002, to study the relationship between fiber physical and structural properties under 2 grades and 2 grade steps using three Egyptian cotton varieties. The studied grades are: Fully good (F. G.) and Fully good fair (F.G.F.). The investigated cotton varieties were Giza 88 (E.L.S.), while Giza 86 (Delta, L. S.) and Giza 90 as Upper Egypt. L.S. variety. All fiber properties were tested in Cotton Technology Research Division, Cotton Research Inst. (C. R. I.) labs. Under constant conditions of temperature (70 + 2F) and relative humidity (65+2F). The studied characters are classified into 2 items.

1- Physical properties :

A-Fiber length at 2.5% span length was determined by Fibrograph 630 according to ASTM (D- 1447 -67), it is the distance spanned by specified% of the fibers in the test beard taking the amount weeding at the starting point of the spanning as 100%.

B- Micronaire value : The Micronaire value which gives an indicator of both fineness and maturity was obtained using Micronaire 675 according to ASTM (D -1448-59).

C-Fiber tenacity:- fiber tensile strength at 1/8 clamp spacing was determined using the Stelometer Tester according to the standard methods of (ASTM Designation D- 1445-67).

D-Fiber stiffness and toughness :- Both of them were calculated according to the following equation, (Grover and Hamby ,1960)

Stiffness (g/tex) = Strength / Elongation.

Toughness (g/tex) = Strength x Elongation /2.

The lint cotton samples of each variety were graded and tested for the mentioned fiber properties in the laboratories of the Cotton Grading Research Section, Cotton Research Inst., Agriculture Research Center, Egypt.

2- Structural properties :

Number of convolutions and reversals per cm. were made on the central part of 200 fibers. convolutions no. were estimated using light microscope at magnification of 500x, also the number of reversals /cm. was calculated by using the polarizing microscope, the fibers were placed parallel to the plane of polarization so that the (s) spirals (right hand spirals) and (z) spiral (left hand spirals) appeared in different colors and the number of reversals (the point in which the color was changed) could be counted according to (Betrabet and Iyennegar,1964).

The complete randomized design with three repetitions and factorial arrangement were used. The obtained results subjected to statically analysis according to producer outlined by Snedecor and Cochran (1981). Means were compared using the least differences (L.S.D.) test at 5% level of propability.

RESULTS AND DISCUSSION

1- Fiber physical properties :

From Table (1) and Fig. (1) , it was obvious that the highest values for length at 2.5%, micronaire value, strength (1/8 inch) and stiffness (g/tex) attributed to Giza 88 var. only, while Giza 86 var. competes with Giza 86 and appears its superiority in fiber strength only, there is no significant difference in this case. The highest value of fiber toughness (97.98 g/tex) is related to Giza 86 var. As for fiber length at 2.5% S.L., Giza 88 var. surpassed by 17.09%, whereas Giza 86 var.outyielded by 8.33% as compared with Giza 90 var. that represented the shortest fibers (28.03 mm). Same trend had been observed for micronaire value, Giza 88 var. surpassed by 7.35%, mean while Giza 86 var. outyielded by 4.76%

Table 1: Mean vales of fiber length at 2.5% S.L. (mm) and micronaire values under different grades and grade steps for some Egyptian cotton varieties, during 2002 season.

The tested varieties	Length at 2.5%(mm)					Micronaire values				
	Grades and grade steps					Grades and grade steps				
	F.G	G/F.G	F.G.F	G.F/F.G.F	Mean	F.G	G/F.G	F.G.F	G.F/F.G.F	Mean
G.88	34.90	35.30	32.50	32.55	33.81	4.10	4.17	3.33	3.06	3.67
G.86	32.70	31.60	29.50	28.50	30.58	4.23	4.23	3.00	2.80	3.57
G.90	29.00	28.50	28.10	26.50	28.03	3.63	3.80	3.08	3.10	3.40
Mean	32.20	31.80	30.03	29.18	30.81	3.99	4.10	3.14	2.99	3.55

L.S.D at 5% level for:-

VAR	0.6585	0.0921
GRADE	0.7604	0.1063
VAR * GRADE	N.S	0.0892

F.G means Fully Good G/ F.G means Good/ Fully Good
 F.G.F means Fully Good Fair G. F /F.G.F means Good Fair/ Fully Good Fair

Table 2: Mean vales of fiber strength at 1/8 inch(g/tex), stiffness and toughness (g/tex) under different grades and grade steps for some Egyptian cotton varieties, during 2002 season.

The tested varieties	Strength at 1/8 inch (g/tex)					Stiffness (g/tex)					Toughness(g/tex)				
	Grades and grade steps					Grades and grade steps					Grades and grade steps				
	F.G	G/F.G	F.G.F	G.F/F.G.F	Mean	F.G	G/F.G	F.G.F	G.F/F.G.F	Mean	F.G	G/F.G	F.G.F	G.F/F.G.F	Mean
G.88	37.27	36.20	33.10	36.10	35.67	7.67	7.47	7.70	7.03	7.47	90.60	87.23	72.03	92.14	85.50
G.86	39.47	35.40	35.47	31.33	35.42	7.08	6.10	6.27	6.38	6.46	110.70	102.70	100.39	78.11	97.98
G.90	28.93	28.12	26.98	28.11	28.04	4.33	4.57	4.27	4.53	4.43	96.98	86.68	85.33	86.53	88.88
Mean	35.22	33.24	31.85	31.85	33.04	6.36	10.80	6.08	5.98	6.12	99.43	92.20	85.92	85.59	90.79

L.S.D at 5% level for:-

VAR	1.7747	0.6252	5.6642
GRADE	2.0492	0.7291	6.5405
VAR * GRADE	N.S	N.S	5.488

F.G means Fully Good G/ F.G means Good/ Fully Good
 F.G.F means Fully Good Fair G. F /F.G.F means Good Fair/ Fully Good Fair

Table 3: Mean vales of number of reversals and number of convolutions under different grades and grade steps for some Egyptian cotton varieties, during 2002 season.

The tested varieties	Number of Reversals					Number of convolutions				
	Grades and grade steps					Grades and grade steps				
	F.G	G/F.G	F.G.F	G.F/F.G.F	Mean	F.G	G/F.G	F.G.F	G.F/F.G.F	Mean
G.88	9.70	14.20	10.80	12.60	11.83	22.80	22.60	28.90	27.30	25.40
G.86	12.30	9.70	10.60	12.30	11.23	27.00	30.40	23.40	27.00	26.95
G.90	8.20	8.50	10.90	7.00	8.65	29.50	26.80	35.80	26.20	29.58
Mean	10.07	10.80	10.80	10.60	10.57	26.43	26.60	29.37	26.83	27.30

F.G means Fully Good G/ F.G means Good/ Fully Good
 F.G.F means Fully Good Fair G. F /F.G.F means Good Fair/ Fully Good Fair

as enduring with Giza 90 var. which considered the coarsest fiber (3.40). Fiber strength at 1/8 inch and stiffness (g/tex) followed the same direction, Giza 88 var. ranked first and overpassed by 21.39%, whereas Giza 86 var. excelled by 20.83% as experiencing with Giza 90 var. that had the weakest fibers (28.04 g/tex), while Giza 86 var. pronounced its superiority in fiber toughness (97.98 g/tex), it was followed by Giza 90 var. (85.50 g/tex). These results may be due to the genetical difference between varieties as reported by Abd-El-Salam (1970). El-Hariry (1980) recorded that cotton varieties had significant effects on flat bundle strength, stiffness and toughness.

In each of the three cotton varieties (G.88, G.86 and G.90), the high lint grade; Fully good and G/F.G. showed the longest, the most mature (high micronaire values) and the higher values of fiber strength and toughness as compared to the lower grades; F.G.F. and G.F./ F.G.F. which exhibited shorter, weaker, lower maturity but higher fiber stiffness.

It was observed that, micronaire values and fiber toughness were significantly affected by (Var. x Grade) interaction. The highest fineness and maturity associated with Giza 88 or Giza 86 as using F.G. or G/ F.G. , while Giza 86 only as using F.G. grade had the highest average (110.70 g/tex) of toughness. In general, gradual decrease in toughness and micronaire values were observed as deterioration in grade levels.

Fiber structural properties:

Data presented in Table (3) cleared that the greatest number of reversals (11.83) attributed to Giza 88 var., while the smallest no. (8.65) associated with G.90 var., on the contrary, the highest convolutions (29.58) was gained from G.90 var., whereas the lowest no. (25.40) was obtained from G.88 var., G.86 represented the medium linkage between the tested varieties for the above parameters. These marked differences may be ought to the genetical diversity between cotton varieties as published by Youssef (1997), who confirmed that cotton varieties should statistical significant differences in the number of reversals per cm. and number of convolutions. It is interesting to note that number of convolutions and reversals had been observed in the tested grades more than the grade steps, i.e. number of reversals was increased in the low grades, while convolutions number/ cm. did not show any conspicuous trend with different grades. These results are in harmony with those reported by Abd El-Gawad et al, (2006).

Fig. (1): The relationship between some Egyptian cotton long staple varieties and its technological properties under some of grades and grade steps.

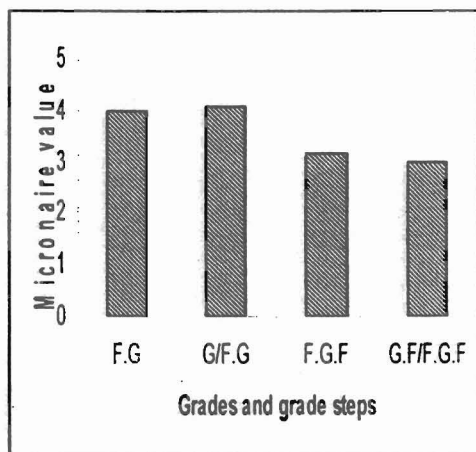
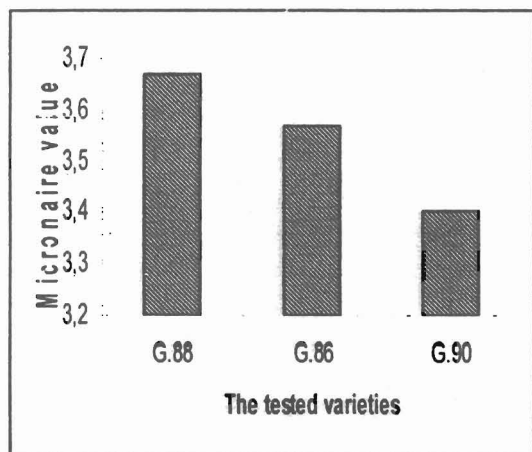
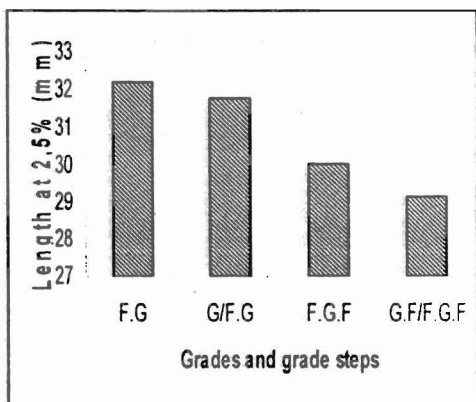
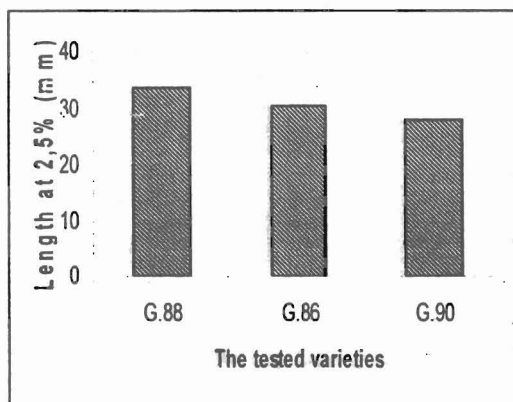
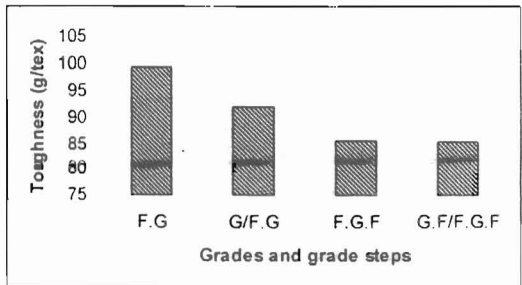
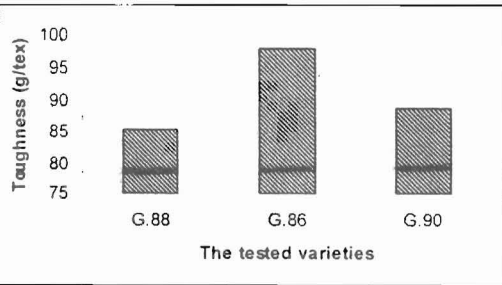
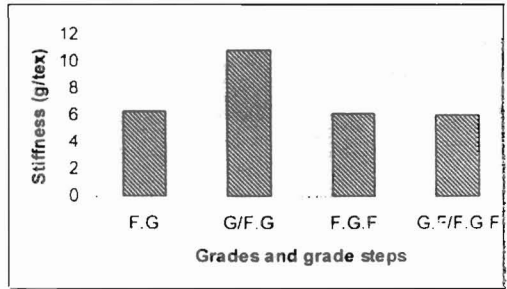
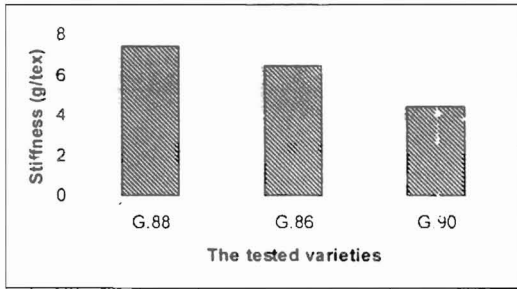
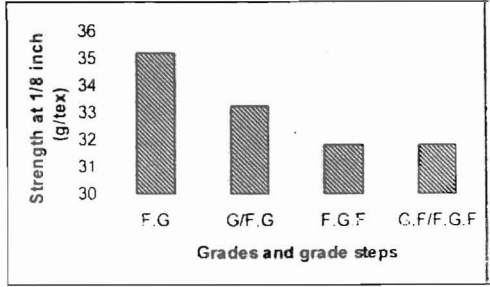
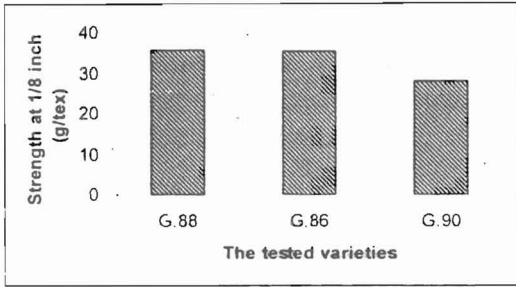


Fig. (1): Continued.



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تأثير رتب الشعر على بعض الصفات الطبيعية والتركيبية في الأقطان المصريه .

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الملخص العربي

اجرى هذا البحث بقسم بحوث الرتب - معهد بحوث القطن - مركز البحوث الزراعيه لعام ٢٠٠٢ لدراسة العلاقات الناشئه ما بين الصفات الطبيعيه لليفة القطن والصفات التركيبية وذلك لثلاثة اصناف من القطن المصري ، احدهما يمثل الأقطان فائقة الطول "جيزه٨٨" بينما الاخيرين يمثلان الأصناف الطويله وهما "جيزه٨٦، جيزه٩٠"

ولقد استخدم في هذا البحث رتبتين رئيسيتين وهما فولى جود، فولى جود فير، ونصفى رتبتين هما جود/ فولى جود، جود فير / فولى جود فير واستخدم التصميم العشوائى الكامل مع وجود ثلاثة تكرارات لكل معاملة . اظهرت النتائج تفوق الصنف جيزه ٨٨ فى الطول عند ٢,٥%، وقيمة الميكرونير ، ومثانة الالياف وصلابتها . اما بالنسبه للاختلافات المعنويه فيما بين الرتب وانصاف الرتب المستخدمه ، فلقد تميزت كل من فولى جود ، جود /فولى جود باحتوائها على اطول الالياف واكثرها مثانه وصلابه ولقد اختلفت عدد الانعكاسات والالتواءات باختلاف الاصناف، ولوحظ زيادة عدد الانعكاسات بالرتب المنخفضه بينما لم تأخذ عدد الالتواءات اتجاهها واضحا .