Annals of Agric. Sci., Moshtohor **ISSN 1110-0419**
Vol. 54(3) (2016), 573–580 **http://annagricmoshj.com**

The relationship between fiber properties and neps formation in yarn for some Egyptian cotton varieties.

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Abstract

The present study was undertaken in Technology, Division, Cotton Research Institute, Agricultural Research Center Giza, seven Egyptian cotton varieties, were taken in the study, three extra-long staple varieties (Giza 45, Giza 88 and Giza 93), two delta long- staple varieties (Giza 86 and Giza 94), and two upper Egypt long- staple varieties (Giza 80 and Giza 90), grown in 2014-2015 season. To study the effect of the factor, the relative importance and the contribution of spain length at 2.5% (SL 2.5% mm (X_1), spain length at 50% (SL 50% mm (X_2), uniformity ratio (UR% (X_3), short fiber Content (SFC% (X_4), mean length (ML mm (X_5), upper half mean length (UHM mm (X_6), uniformity index (UI% (X_7), spain length at 66.7% (SL 66.7% mm (X_8), coefficient of variation length (C.v% (X_9), micronaire reading (Mic (X_{10}), fiber strength in gram/Tex (Str. g/tex (X_{11}), fiber elongation (Elon.% (X_{12}), maturity ratio (MR% (X_{13}), and neps formation (neps cnt./g). in cotton yarns.

From the path coefficient analysis, it was concluded that Micronaire reading was the most important causative factor inducing neps in cotton yarns. In fact, Micronaire reading exerted influence both directly and indirectly upon neps count. Fiber length showed a moderate effect, while fiber stiffness revealed the lowest effect on yarn neps count compared with the other two factors.

Key words: Cotton fiber, fiber quality, fiber properties, neps formation in cotton yarns.

Introduction

Neps are small and fairly tight tangles of cotton fibers; they appear as white specks, commonly no larger than a pin head**.**

Ahmed *et al,* (1984), stated that micronaire value exerted the greatest influence, weather directly or indirectly, upon yarn neps, followed by fiber length which appeared a moderate effect. **Al-Tantawy (1977),** reported that there was an inverse and significant correlation between yarn nippiness and Micronaire reading, while fiber stiffness was positively and significantly related to yarn neps count. He stated that stiffer fibers tend to break during processing and therefore contribute to neps 'formation. Also, he mentioned that fiber length showed insignificant positive or negative correlations with yarn neps count. **El-Ghawas *et al,* (1978),** found that, on the basis of the relative net effect on pertinent fiber properties on yarn neps, micronaire value ranked first, followed by fiber length**. Garawain (1976),** using the multiple and partial correlations found that Micronaire reading ranked first in regard to the importance to neps formation, followed by fiber 2.5% span length and fiber stiffness, in this respect. He added that within a variety, Micronaire reading, independently, was the most important factor for predicting neps potentiality compared with the other fiber properties. **Hager *et al* (2011**), indicated that, the present investigation was carried out to determine the relative importance of fiber properties (the upper half mean length, fiber strength and maturity) to explain the variation of yarn strength, yarn nep count and evenness in two spinning systems (ring and compact) using two categories of cotton varieties (extra-long staple and long staple).All the supposed models of regression were significant and reflected large part of the variation of studied yarn properties expressed as high values of R2 and near values of the corresponding adjusted R2 indicating the validity and goodness of fit for these models. **Hussein *et al,* (1973),** found significant relationships between the number of neps in yarn and each of Micronaire reading and maturity ratio, depending on the cotton variety. On the other hand, the relationships between the number of neps in yarn and either fiber length or fiber stiffness were relatively unappreciable. **Marth *et al,* (1952),** reported that micronare value was an excellent index of the number of neps expected in card web. **Rusca (1970),** stated that neps rapidly decreased with increase in micronaire reading while yarn irregularity slightly decreased with either extra-long fine or extra-coarse micronaire reading.

Materials and Methods

The materials used in the present study delivered, prepared and tested at Technology, Division, Cotton Research Institute, and Agricultural Research Center

Giza, seven Egyptian cotton varieties, were taken in the study, three extra-long staple varieties,(Giza 45, Giza 88 and Giza 93), two delta long- staple varieties, (Giza 86 and Giza 94), and two upper Egypt long- staple varieties,(Giza 80 and Giza 90), grown in 2013-2014 season.

Characters studied: under controlled atmospheric condition of (70±2°F) temperature and (65±2%) relative humidity.

Fiber length parameters: was measured on the Digital Fibrograph **at KEISOKKI (2013)** the following fiber properties were measured using Keisokki **-** kcf-v/ls version 1.29.3.Instrument high volume fiber length test system.

(a)span length at 2.5% (SL 2.5% mm)
(b)spain length at 50% (SL 50% mm)
(c)uniformity ratio (UR%)
(d)short Fiber contented (SFC %)
(e)mean length (ML mm)
(f)upper half mean length (UHM mm)
(g)uniformity index (UI%)
(h)spain length at 66.7% (SL 66.7% mm)
(i)coefficient of variation length (C.v%)

Fiber mechanical characters:-

(a) fiber strength in gram / Tex (St. (g/tex)

(b) fiber elongation % (Elon.) the percentage of Elongation, which occurs before a fiber bundle breaks.

(c) fiber strength at 1/8 inch. (St. at1/8 g/tex) in gauge/length.

was determined by **Stelometer** instrument, according to **(A.S.T.M) American Society for Testing and Materials (1986).**

Maturity ratio (MR%): Determining maturity ratio by using Micromat Tester**. S.D.L 089, (1994).**

Micronaire reading:

Micronaire reading (Mic.) that is a measurement for the combination of fiber fineness and maturity was measured by **Uster** Micronaire 675.In this method the fiber sample is weighted on an electronic balance. This mass is accepted if its weight is between 9.5 and 10.5 grams from the measured values of mass and pressure, the microprocessor calculates specific surface from which the fineness and maturity value were derived. The tests were done according to Uster Instruction Manual.

Neps formation:

In carded yarns produced at count (Ne) 60 3.6 T. M carded ring spinningwas measured on the Uster Tester **3** according to **A.S.T.M. (1986)** designation, (D 1425-60 T) and reported as the number of neps per 120 yards.

The simple correlation coefficients between the different variables were calculated according to the procedure outlined by **little and Hills (1978)**. The path coefficient analysis which was first pub listed by **Wright (1921)** and used by **Dewey and Lu (1959),** was employed to determine the contribution of fiber properties, and fiber stiffness to yarn neps.

Calculation:

Means were calculated from the 20 repetitions for each variety to compute the correlation coefficients and stepwise multiple regression analysis which was carried with a: Regression equation of the following from:

The Best Equations (Y_{1-a})$=€ + €_1 X_1 + €_2 X_2 + €_3 X_3 + \ldots\ldots + €_n X_n$

Where: **(Y_{1-a})** is the dependent variable "yarn neps formation".

€ ($€_1 + €_2$ ….to $€_n$) is the constant, $X_1 + X_2$ ….. to X_n are the independent variables.

$X_{1....n}$ is the characteristics (fiber properties).

Non-significant ( ), significant at 0.05 (*) and high significant at 0.01(**) probability.

R^2=Maximum contribution to the coefficient of determination.

The regression coefficient to evaluate the relative contribution by determining the most effective independent variables, which make the maximum contribution to the coefficient of determination (R^2) "stepwise" regression affecting yarn neps.

Stepwise multiple linear regression analysis was used to determine what of the fiber properties that accounted for the majority of the total variation of yarn quality properties as described by **Draper and Smith (1981).**

Results and Discussion

For the selection of a suitable raw material for high spun yarn quality, spinners are interested in knowing the effect of fiber properties on yarn neps formation. Therefore, we have devoted our attention to the correlation and contributor of fiber parameters i.e. spain length at 2.5% (SL 2.5% mm (X_1), spain length at 50% (SL 50% mm (X_2), uniformity ratio (UR% (X_3), short fiber Content (SFC% (X_4), mean length (ML mm (X_5), upper half mean length (UHM mm (X_6), uniformity index (UI% (X_7), spain length at 66.7% (SL 66.7% mm (X_8), coefficient of variation length (C.v% (X_9), micronaire reading (Mic (X_{10}), fiber strength in gram/Tex (Str. g/tex (X_{11}), fiber elongation (Elon.% (X_{12}), maturity ratio (MR% (X_{13}), and number neps in yarn (neps cnt./g).

The results sometimes differ because of the nature of different measuring principles. It is generally accepted that a certain level of neps formation in yarn is unavoidable, owing to the practical limitations of mechanical processing machines. As previously stated, measuring yarn neps formation was by using method:

the **Uster® Tester (U.T 3).** The instrument provides a neps formation parameter: (expressed as the total hair length per yarn centimeter, and hence unit less). Mean, minimum and maximum values for neps formation by using spinning processes ring within each of variety under study, are presented in **Table (1).** It could be noticed that values of neps formation occurred in yarns manufactured by the carded ring spinning frame the same count (Ne 60 carded ring spinning) in all studied varieties. i.e., mean values for neps formation for variety Giza 80 gave the highest value of (114). With regard to, then variety Giza 90 at (104.4), then variety Giza 86 at (88.0, then variety Giza 88 at (84.2), then variety Giza 45 at (75.0), then variety Giza 94 at (68.5). Generally the comparison of mean values for yarn neps formation due to machines effects indicated that, the less mean value of neps formation (64.1) was obtained from fiber of Giza 93 that manufactured to yarn, the highest mean value. Respectively, this trend was obtained in all varieties under study. **El Mogahzy (2000), Krifa and Ethridge (2003), Krifa and Ethridge (2006) and Strumiłło *et al* (2007),** came to similar conclusion.

Table 1. Summary of minimum, maximum and mean values of fiber properties and neps formation in yarn for seven Egyptian cotton varieties.

Fiber properties Varieties		SL 2.5% (X_1)	SL 50% (X_2)	UR% (X_3)	SFC% (X_4)	ML (X_5)	UHM (X_6)	UI% (X_7)	SL 66.7% (X_8)	CV% (X_9)	Mic (X_{10})	Str. (X_{11})	Elon (X_{12})	MR% (X_{13})	neps
Giza 93	min	35.5	17.7	48.00	2.7	30.5	36.5	86.16	13.0	21.2	2.8	45.2	6.0	0.90	63.0
	max	38.3	19.3	51.20	3.8	34.8	38.8	91.1	14.2	25.2	3.3	49.0	7.8	0.96	88.0
	mean	37.22	18.49	49.67	3.25	33.52	37.91	88.44	13.57	22.98	3.04	47.14	6.71	0.924	64.1
Giza 45	min	34.7	16.3	46.80	2.8	29.7	34.3	85.0	12.1	21.6	2.6	44.5	6.0	0.89	58.0
	max	37.8	19.0	51.70	6.1	34.3	37.7	91.5	14.0	27.6	3.5	48.9	7.9	0.92	98.0
	mean	35.73	17.65	49.38	3.73	31.90	36.21	88.09	13.00	23.65	3.02	46.28	7.12	0.903	75.0
Giza 88	min	34.9	16.8	46.70	3.0	30.7	35.8	85.3	12.5	20.9	3.6	43.0	6.2	0.95	54.0
	max	36.8	18.6	52.10	5.1	33.6	37.4	91.8	14.1	27.4	4.3	47.9	7.9	0.99	114
	mean	35.85	17.52	48.88	3.96	31.84	36.44	87.37	12.96	24.37	3.94	46.26	6.61	0.968	84.2
Giza 94	min	32.1	15.3	46.50	3.7	27.8	32.0	84.6	11.4	22.7	4.0	39.3	7.0	0.91	40.0
	max	34.5	17.4	50.40	7.2	31.1	35.2	89.6	12.9	28.4	4.8	41.9	7.9	0.99	89.0
	mean	33.36	16.27	48.88	4.62	29.27	33.82	86.94	12.12	24.53	4.38	41.08	7.26	0.950	68.5
Giza 86	min	33.2	15.0	45.20	3.6	27.5	33.4	82.1	11.2	22.9	4.0	40.0	6.6	0.95	55.0
	max	35.2	17.4	49.90	7.2	31.2	35.8	88.6	12.8	31.4	4.6	49.5	7.9	0.99	121
	mean	34.22	16.46	48.10	4.80	29.84	34.70	85.92	12.22	25.44	4.31	45.40	7.10	0.966	88.0
Giza 90	min	30.6	14.4	45.40	4.3	26.3	31.1	82.7	10.9	23.3	3.4	32.0	6.5	0.91	60.0
	max	32.0	16.2	50.60	8.9	28.7	32.3	89.1	12.0	30.2	4.2	39.0	7.8	0.98	152
	mean	31.48	15.12	48.03	5.85	27.10	31.66	85.58	11.33	26.16	3.81	35.88	7.49	0.932	104.4
Giza 80	min	30.6	14.1	45.00	3.9	25.7	30.6	80.6	10.7	20.7	4.0	35.5	7.1	0.88	66.0
	max	34.3	16.6	52.40	9.6	29.5	33.4	91.0	12.2	31.9	4.5	43.8	8.0	0.98	168
	mean	31.95	15.21	47.53	6.12	27.38	32.19	84.98	11.40	26.90	4.20	39.43	7.60	0.930	114

Spain length at 2.5% **(SL 2.5% mm (X_1),** Spain length at 50% **(SL 50% mm (X_2)**, uniformity ratio **(UR% (X_3)**, Short Fiber Content **(SFC% (X_4),** Mean length **(ML mm (X_5),** upper half mean length **(UHM mm (X_6)**, uniformity index **(UI% (X_7)**, Spain length at 66.7% **(SL 66.7% mm (X_8),** Coefficient of variation length **(C.v% (X_9),** Micronaire reading **(Mic (X_{10}),** Fiber strength in gram/Tex **(Str. g/tex (X_{11}),** fiber elongation **(Elon.% (X_{12})**, Maturity ratio **(MR% (X_{13}), and** number neps in yarn (neps cnt./g)**.**

Correlation coefficients between yarn neps formation and fiber properties

Correlation coefficients were computed within each variety processes ring within each of variety under study between each of fiber properties and neps formation in yarn correlated was negative and significant in all cases.

The data shown in **Table (2)** clearly indicate that there was a downward trend as for the spain length at 2.5% (SL 2.5% mm (X_1), spain length at 50% (SL 50% mm (X_2), uniformity ratio (UR% (X_3), short fiber Content (SFC% (X_4), mean length (ML mm (X_5), upper half mean length (UHM mm (X_6), uniformity index (UI% (X_7), spain length at 66.7% (SL 66.7% mm (X_8), coefficient of variation length (C.v% (X_9), micronaire reading (Mic (X_{10}), fiber strength in gram/Tex (Str. g/tex (X_{11}), fiber elongation (Elon.% (X_{12}), maturity ratio (MR% (X_{13}), with increasing of neps formation yarns at the same count, this positive relationship between Fiber properties at this and yarn neps formation was confirmed by the highly significant correlation coefficients obtained, conversely correlation coefficients for fiber strength (g/tex) uniformity ratio (UR%), uniformity index (UI%), in all and spain length at 66.7% (SL 66.7%mm),), micronaire reading (Mic) in Giza 86, micronaire reading (Mic) in Giza 80,varieties are also high but with negative signs.

On the other hand, there was a consistent pattern of increase in neps formation in all types of yarns with the diminish of maturity ratio. Hence, correlation coefficients between neps formation in all types of yarns and the previously properties were significantly negative in all the varieties involved in the study. On the contrary the correlation coefficients have negative signs, high and are very high between uniformity ratio (UR%), UI%, fiber strength in gram/Tex (Str. g/tex) uniformity index (UI%), and fiber elongation (Elon.%) in all varieties. In this respect, it is rather interesting to note that in all types of yarns and all studied varieties, the increase of spain length at 2.5% (SL 2.5%mm), spain length at 50% (SL 50%mm), short fiber content (SFC w %), mean length (ML mm), upper half mean length (UHM mm), Mean length (ML mm), upper half mean length (UHM mm), Spain length at 66.7% (SL 66.7%mm), Coefficient of variation length (C.v% (X9), Micronaire reading (Mic), and decrease in fiber strength (g/tex), uniformity ratio (UR%), uniformity index (UI%), are important contributors toward increased yarn neps formation index. These finding are in the same line with **Zurek *et al* (1996), Hequet and Ethridge (2000), Pearson (1944). and Zhang *et al* (2003).**

Table 2. Coefficients of simple correlation between yarn neps formation and each of fiber properties for some Egyptian cotton varieties.

Fiber. properties / Varieties	SL 2.5% (X_1)	SL 50% (X_2)	UR% (X_3)	SFC% (X_4)	ML (X_5)	UHM (X_6)	UI% (X_7)	SL 66.7% (X_8)	CV% (X_9)	Mic (X_{10})	Str. (X_{11})	Elon (X_{12})	MR (X_{13})
Giza 93	**0.98****	**0.96****	**-0.97****	**0.96****	**0.97****	**0.98****	**-0.99****	**0.96****	**0.98****	**0.92****	**-0.95****	**-0.92****	**0.51**
Giza 45	**0.97****	**0.90**	**-0.99****	**0.99****	**0.98****	**0.97****	**-0.98****	**0.96****	**0.94****	**0.96****	**-0.97****	**-0.93****	**0.18**
Giza 88	**0.96****	**0.88**	**-0.96****	**0.94****	**0.87****	**0.96****	**-0.95****	**0.84****	**0.96****	**0.81****	**-0.85****	**-0.89****	**0.50**
Giza 94	**0.96****	**0.96**	**-0.89****	**0.78****	**0.97****	**0.97****	**-0.88****	**0.97****	**0.79****	**0.87****	**-0.87****	**-0.96****	**0.39**
Giza 86	**0.93****	**0.95**	**-0.97****	**0.95****	**0.96****	**0.81****	**-0.95****	**0.71****	**-0.77****	**-0.98****	**-0.97****	**-0.79****	**0.28**
Giza 90	**0.95****	**0.93**	**-0.93****	**0.88****	**0.95****	**0.97****	**-0.95****	**0.95****	**0.92****	**0.96****	**-0.95****	**-0.88****	**0.56***
Giza 80	**0.93****	**0.97**	**-0.92****	**0.95****	**0.96****	**0.96****	**-0.95****	**0.96****	**0.93****	**-0.95****	**-0.97****	**-0.94****	**0.98****

Spain length at 2.5% **(SL 2.5% mm (X_1),** Spain length at 50% **(SL 50% mm (X_2)**, uniformity ratio **(UR% (X_3)**, Short Fiber Content **(SFC% (X_4),** Mean length **(ML mm (X_5),** upper half mean length **(UHM mm (X_6)**, uniformity index **(UI% (X_7)**, Spain length at 66.7% **(SL 66.7% mm (X_8)**, Coefficient of variation length **(C.v% (X_9),** Micronaire reading **(Mic (X_{10}),** Fiber strength in gram/Tex **(Str. g/tex (X_{11}),** fiber elongation **(Elon.% (X_{12}),** Maturity ratio **(MR% (X_{13}), and** number neps in yarn (**neps cnt./g).** Non-significant ( ), significant at 0.05 (*) and high significant at 0.01(**) probability.

The results of multiple linear regression analysis between each one of three yarn properties (yarn strength, neps and evenness) as dependent variable and six fiber properties as explanatory variables under ring spinning system for two categories of cotton varieties are presented in **Table (3).** The results revealed that the supposed multiple regression models were significantly explained the most variability of the three yarn properties over the two types of cotton variety.

Statistically, goodness of fit was satisfied for the six supposed models where the coefficients of determination (R^2 %) ranged from 78.3 to 95.5 indicating that the most yarn properties variation was attributed to the tested fiber properties. The residuals content (1- R^2 %) may be returned to some errors during measuring the fiber and yarn properties, some fiber properties were not into account under the current investigation and/or unknown variation (random error).

On the other hand, the values of adjusted R^2 were very close to their corresponding R^2 values giving evidence on the goodness of fit for the supposed models. Similar trend of results was obtained by **Fares *et al*, (2010).**

Table 3. Full model regression analysis to predict of neps formation using thirteen fiber properties for some Egyptian cotton varieties

Fiber properties varieties	cons tant	SL 2.5% (X_1)	SL 50% (X_2)	UR % (X_3)	SFC % (X_4)	ML (X_5)	UHM (X_6)	UI% (X_7)	SL 66.7 % (X_8)	CV % (X_9)	Mic. (X_{10})	Str. (X_{11})	Elon. (X_{12})	MR (X_{13})	R^2
Giza 93	**- 467**	**-10.6**	**12.0**	**920**	**151**	**2.68**	**17.4**	**-438**	**-0.30**	**752**	**8.5**	**-1.04**	**-131**	**-73.3**	**99.8**
Giza 45	**-176**	**6.24**	**2.58**	**-78**	**0**	**0.92**	**2.47**	**-4.00**	**-2.01**	**-56**	**3.2**	**-0.38**	**-78**	**-45**	**99.0**
Giza 88	**- 473**	**4.50**	**13.5**	**-909**	**-1132**	**-6.9**	**18.6**	**-47.0**	**-4.10**	**-174**	**16.7**	**1.94**	**-582**	**219**	**99.3**
Giza 94	**1660**	**1.85**	**27.3**	**471**	**-1132**	**21.2**	**-7.95**	**-1369**	**-31.2**	**75**	**-54.7**	**-12.6**	**-409**	**-310**	**99.5**
Giza 86	**- 63**	**5.61**	**-1.06**	**-888**	**-848**	**8.78**	**-1.79**	**311**	**0.71**	**12**	**-23.6**	**-1.95**	**-219**	**177**	**99.2**
Giza 90	**-3051**	**71.0**	**-40.6**	**3819**	**-1491**	**-18.4**	**69.5**	**-40.0**	**-71.6**	**3298**	**-66.8**	**-8.40**	**-12327**	**-486**	**99.6**
Giza 80	**-2076**	**23.7**	**23.7**	**378**	**39**	**-23.0**	**31.2**	**465**	**24.4**	**-245**	**-81.9**	**-0.78**	**612**	**261**	**99.1**

Spain length at 2.5% **(SL 2.5% mm (X_1),** Spain length at 50% **(SL 50% mm (X_2)**, uniformity ratio **(UR% (X_3)**, Short Fiber Content **(SFC% (X_4),** Mean length **(ML mm (X_5),** upper half mean length **(UHM mm (X_6)**, uniformity index **(UI% (X_7)**, Spain length at 66.7% **(SL 66.7% mm (X_8),** Coefficient of variation length **(C.v% (X_9),** Micronaire reading **(Mic (X_{10}),** Fiber strength in gram/Tex **(Str. g/tex (X_{11}),** fiber elongation **(Elon.% (X_{12}),** Maturity ratio **(MR% (X_{13}), and** number neps in yarn (**neps cnt./g).**
R^2=Maximum contribution to the coefficient of determination. **(y)** Dependent variable=$Є + Є_1$ **X_1** + $Є_2$ **X_2** + $Є_3$ **X_3** +………. + $Є_n X_n$

Contribution of cotton fiber properties to yarn neps formation:

Stepwise regression procedure has been applied to determine the most effective independent variables which make the maximum contributions to the coefficient of determination (R^2), the prediction equations and coefficients of determination (R^2) of the best model and rank of contributors (best 1-variable, the best 2-variables and 3-variables) to yarn neps formation obtained from fiber of three extra-long staple varieties,(Giza 45, Giza 88 and Giza 93), two delta long- staple varieties, (Giza 86 and Giza 94), and two upper Egypt long- staple varieties,(Giza 80 and Giza 90), between fiber properties i.e. spain length at 2.5%, spain length at 50%, uniformity ratio (UR%), short fiber content (SFC w %), mean length (ML), upper half mean length (UHM), uniformity index (UI%), spain length at 66.7%, coefficient of variation length (C.v%), micronaire reading (Mic), fiber strength (g/tex) and fiber elongation (Elon.%) and maturity ratio(MR), in all verities under study, were correlated negatively and significantly with neps formation in yarn are presented in **Tables (4).**

It can be seen that as the variety is changed, the order and amount of fiber parameters to yarn neps formation differed from one variety to another. Moreover, in the same variety, the order and amount of contribution of thirteen fiber parameters differed according to processes of yarn neps formation.

The best contributor to neps formation (Y_{1-A}) was uniformity index (UI %) with upper half mean length (UHM) an R^2=99.1, and the maximum contributors to neps formation (Y_{1-B}) were uniformity index (UI%) the best contributor to neps formation with an R^2= 97.8, in Giza 93. The best contributor to neps formation (Y_{2-A}) was uniformity ratio (UR%), uniformity index (UI%), spain length at 2.5% (SL 2.5%) upper half mean length (UHM) an R^2=99.6, the maximum contributors to neps formation (Y_{2-B}) were uniformity ratio (UR%), uniformity index (UI %), spain length at 2.5% (SL 2.5%) the best contributor to neps formation with an R^2= 99.3, the maximum contributors to neps formation (Y_{2-C}) were uniformity ratio (UR%), uniformity index (UI %), the best contributor to neps formation with an R^2= 98.8 and the maximum contributors to neps formation (Y_{2-D}) were uniformity ratio (UR%), the best contributor to neps formation with an R^2= 97.0, in Giza 45.The best contributor to neps formation (Y_{3-A}) was uniformity ratio (UR%), micronaire reading (Mic), coefficient of variation length (C.v%) and upper half mean length (UHM) the best contributor to neps formation with an R^2=98.6, the maximum contributors to neps formation (Y_{3-B}) were uniformity ratio (UR) micronaire reading (Mic), coefficient of variation length (C.v%) the best contributor to neps formation with an R^2= 98.2, the maximum contributors to neps formation (Y_{3-C}) were uniformity ratio (UR%),) micronaire reading (Mic), the best contributor to neps formation with an R^2= 97.6 and the maximum contributors to neps formation (Y_{3-D}) were uniformity ratio (UR%), the best contributor to neps formation with an R^2= 93.8, in Giza 88.

The best contributor to neps formation (Y_{4-A}) was mean length (ML), fiber elongation (Elon.%) and Short Fiber Content (SFC w%) the best contributor to neps formation with an R^2=98.2, the maximum contributors to neps formation (Y_{4-B}) were mean length (ML) and fiber elongation (Elon.%) the best contributor to neps formation with an R^2= 97.7, the maximum contributors to neps formation (Y_{4-C}) were mean length (ML) the best contributor to neps formation with an R^2= 94.8 in Giza 94. The best contributor to neps formation (Y_{5-A}) was micronaire reading (Mic), uniformity ratio (UR%), mean length (ML) and maturity ratio (MR%) the best contributor to neps formation with an R^2=99.1, the maximum contributors to neps formation (Y_{5-B}) were micronaire reading (Mic), uniformity ratio (UR%) and mean length (ML) the best contributor to neps formation with an R^2= 98.5, the maximum contributors to neps formation (Y_{5-C}) were micronaire reading (Mic) and uniformity ratio (UR%) the best contributor to neps formation with an R^2= 97.8 and the maximum contributors to neps formation (Y_{5-D}) were micronaire reading (Mic), the best contributor to neps formation with an R^2= 95.7, in Giza 86. The best contributor to neps formation (Y_{6-A}) was upper half mean length (UHM) and uniformity index (UI %) with an R^2=97.7, and the maximum contributors to neps formation (Y_{6-B}) were upper half mean length (UHM) the best contributor to neps formation with an R^2= 95.4, in Giza 90. The best contributor to neps formation (Y_{7-A}) was maturity ratio (MR%), spain length at 50% (SL 50%), micronaire reading (Mic), fiber elongation (Elon.%) and mean length (ML) the best contributor to neps formation with an R^2=98.0, the maximum contributors to neps formation (Y_{7-B}) were maturity ratio (MR%), spain length at 50% (SL 50%), micronaire reading (Mic) and fiber elongation (Elon.%) the best contributor to neps formation with an R^2= 96.9 the maximum contributors to neps formation (Y_{7-C}) were maturity ratio (MR%), spain length at 50% (SL 50%) and micronaire reading (Mic) the best contributor to neps formation with an R^2= 96.7, the maximum contributors to neps formation (Y_{7-D}) were maturity ratio (MR%) and spain length at 50% (SL 50%) the best contributor to neps formation with an R^2= 96.0 the maximum contributors to neps formation (Y_{7-E}) were maturity ratio (MR%), the best contributor to neps formation with an R^2= 95.2, in Giza 80.

Table 4. Stepwise multiple liner regression to predict number of neps using thirteen fiber properties for some Egyptian cotton varieties.

varieties	The Best Equations	R^2
Giza 93	Y_{1-A}=1056.6 – 1122 UI%	97.8
	Y_{1-B}=345.8 – 674UI% + 8.3 UHM	99.1
Giza 45	Y_{2-A}=494.39 – 848 UR%	97.0
	Y_{2-B}=587.41 – 481 UR% – 311 UI%	98.8
	Y_{2-C}=382.54 – 311 UR% – 291 UI% + 2.88 SL 2.5%	99.3
	Y_{2-D}=34.17 – 204 UR% – 139 UI% + 3.58 SL 2.5% + 3.76 UHM	99.6
Giza 88	Y_{3-A}=655.4 – 1169 UR%	93.8
	Y_{3-B}=362.2 – 1085 UR% + 261 MR	97.6
	Y_{3-C}=702.9 – 1746 UR% + 397 MR – 613 CV%	98.2
	Y_{3-D}=335.5 – 1555 UR% + 338 MR – 622 CV% + 9.2 UHM	98.6
Giza 94	Y_{4-A}= – 338.976 + 13.87 ML	94.8
	Y_{4-B}=1.419 + 8.03 ML – 2328 Elon. %	97.7
	Y_{4-C}= – 130.585 + 11.59 ML – 1757 Elon.% – 301SFC%	98.2
Giza 86	Y_{5-A}=511.9 – 98.2 Mic	95.7
	Y_{5-B}=675.4 – 58.7 Mic – 694 UR%	97.8
	Y_{5-C}=389.2 – 35.2 Mic – 640 UR% – 5.3 ML	98.5
	Y_{5-D}= – 214.0 – 22.0 Mic – 273 UR% + 11.5 ML + 193 MR	99.1
Giza 90	Y_{6-A}= – 2038.2 + 67.7 UHM	95.4
	Y_{6-B}= – 695.5 + 44.2 UHM - 699 UI%	97.7
Giza 80	Y_{7-A}= – 831.8 + 1019 MR	95.2
	Y_{7-B}= – 701.7 + 661 MR + 13.3 SL 50%	96.0
	Y_{7-C}= – 217.1 + 403 MR + 13.0 SL 50% – 57 Mic	96.7
	Y_{7-D}=– 666.7 + 559 MR + 19.2 SL 50% – 72 Mic + 3639 Elon.%	96.9
	Y_{7-E}= – 801.6 + 751 MR + 38.25 SL 50% – 6.7 Mic + 4008 Elon.% –13.9 ML	98.0

Spain length at 2.5% **(SL 2.5% mm (X_1),** Spain length at 50% **(SL 50% mm (X_2)**, uniformity ratio **(UR% (X_3)**, Short Fiber Content **(SFC% (X_4),** Mean length **(ML mm (X_5),** upper half mean length **(UHM mm (X_6)**, uniformity index **(UI% (X_7)**, Spain length at 66.7% **(SL 66.7% mm (X_8),** Coefficient of variation length **(C.v% (X_9),** Micronaire reading **(Mic (X_{10}),** Fiber strength in gram/Tex **(Str. g/tex (X_{11}),** fiber elongation **(Elon.% (X_{12}),** Maturity ratio **(MR% (X_{13}), and** number neps in yarn (**neps cnt./g). R^2=Maximum contribution to the coefficient of determination. (Y) Dependent variable "yarn neps formation"= $€ + €_1 X_1 + €_2 X_2 + €_3 X_3 + \ldots\ldots + €_n X_n$ € is the constant $X_1 + X_2$ ….. to X_n are the independent variables.**

Generally, from the previously finding it can be noticed that the most effective fiber properties for predicting yarn neps formation were spain length at 2.5%, spain length at 50%, uniformity ratio (UR%), short fiber content (SFC w %), mean length (ML), upper half mean length (UHM), uniformity index (UI%), spain length at 66.7%, coefficient of variation length (C.v%), micronaire reading (Mic), fiber strength (g/tex) and fiber elongation (Elon.%) and maturity ratio(MR). Therefore the rate of improvement in yarn neps formation due to decrease short fiber content (the larger the share of fibers in the shorter length the higher is the neps formation, increase fiber strength (more mature fiber) and increasing fiber length as yarn gets coarser (the larger the share of the fibers in longer length the lower is the neps formation. **Zurek *et al*, (1996), Zhang *et al*, (2003), Sagbaş and Erol (2004) Altaş and Kadoğlu (2006) and Ahmed, *et. al.* (2016)** came to similar conclusions.

Finally, the current investigation reached the following conclusions or remarks:-

1-The results of the supposed regression models differed according to the category of the used cotton variety and also the kind of the applying spinning system.

2-The current results helps the spinner to predict the spinning performance using the available fiber properties as well as choosing cotton that are best suited to the manufacture of the end products.

3-Statistically, goodness of fit was satisfied for all regression models under the present investigation.

4-The residuals content ($1-R_2$) may be attributed to three reasons being the committed errors during measuring fiber and yarn properties, some considerable fiber properties were not into account and/ or unknown variation (random error).

5-The stepwise regression procedure determined the minimum number of fiber characters that are accounted for the most variation of various yarn properties which save the time and effort.

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العلاقه بين صفات التيله وتكوين العقد فى خيوط الغزل لبعض أصناف القطـــن المصرى

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أجريت هذه الدراسة في معامل بحوث شعبة التكنولوجى، بمعهد بحوث القطن، مركز البحوث الزراعية الجيزة، على سبعة أصناف من القطن المصري، ثلاثة أصناف فائقة الطول هى، (جيزة 45، جيزة 88 وجيزة 93)، وصنفان من طويل بحرى هما، (جيزة 86 وجيزة 94)، واثنان من طويل قبلى، (جيزة 80 وجيزة 90)، خلال موسم 2013 – 2014 لدراسة العلاقه بين صفات التيله وهى (الطول عند 2.5٪ (SL 2.5%mm)، الطول عند 50٪ (SL 50%mm)، الإنتظاميه (% UR)، محتوى الألياف من الشعيرات القصيره (SFC%)، متوسط الطول (ML)، طول أطول الشعيرات (UHM)، الإنتظاميه (UI%)، الطول عند 66.7٪ (SL66.7%)، معامل الاختلاف (C.v%)، قراءة الميكرونير (Mic)، المتانه (Str.g/tex) ، الإستطالة (Elon.%)، ونسبة النضج (MR%)، وتكوين العقد (Neps) في خيوط الغزل .

وقد تم استخدام كل من تحليل الانحدار المتعدد، تحليل الانحدار المتعدد المرحلي لتحقيق هذا الهدف.

وقد أوضحت النتائج أن صفات التيلة الأكثر إسهاماً في تكوين العقد فى الخيط تختلف من صنف لآخر ومن فئة إلي أخري .

وبوجه عام أشارت النتائج أن صفة الميكرونير وطول أول الشعيرات ومتوسط الطول ومعامل إختلاف الطول والنعومة أعطت معنويه عاليه وعلاقه موجبه بإستثناء صفة الإنتظاميه والمتانه والإستطاله للأصناف موضع الدراسه حيث أعطت معنويه عاليه وعلاقه سالبه.

من ناحية أخرى فإن جميع نماذج الانحدار المقترحة كانت معنوية وأعطت قيم مرتفعة من معامل التحديد (R^2) مما يشير إلى جودة التوفيق لهذه النماذج.

من تحليل معامل الطريق، إستنتج بأنّ قراءة الميكرونير (.Mic) ونسبة الشعيرات القصيره، كانت العامل المسبب الأكثر أهمية الذي يؤدى إلى تكوين العقد (neps) في غزول القطن.

في الحقيقة، كان لقراءة الميكرونير (.Mic) تأثير كبيراً بشكل مباشر وغير مباشر على تكوين العقد (neps)، بينما كشفت المتانه والإستطاله التأثير الأقل أو تأثيراً معتدلاً على تكوين العقد فى غزول الخيط.