THE IMPACT OF NEW SPINNING TECHNOLOGIES ON THE EGYPTIAN COTTONS

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Abstract

This research work was conducted mainly to find out the impact of the new spinning technology, i.e. the compact spinning system on the yarn quality parameters as compared to those of yarns spun on the conventional ring spinning system in current use in the spinning industry. The mechanism of Compact spinning is narrowing and decreasing the width of the band of fibers which come out from the drawing apparatus before it is twisted into yarn, and the elimination of the twisting triangle. This causes the fiber stream in the form of the flat band of fibers to be condensed into a compact fiber stream with increased the attached points between the fibers.

The materials used included; (1) six Long-Staple cotton varieties grown in Upper Egypt and Delta, chosen to produce 30s and 40s count yarns spun at three different twist multipliers; 3.2, 3.6 and 4.0, (2) four Extra-Long Staple cotton varieties and also, Giza 86, used to produce extra fine carded yarns i.e., 60's, 80's and 100's at 3.6 twist multiplier.

The yarns spun on the compact spinning system are characterized by higher tenacity, higher elongation at break, smaller mass irregularity measured at short segments, and significantly lower hairiness in comparison with yarns spun on the conventional ring spinning frame. For the Long Staple Egyptian cotton varieties, the breaking force or single yarn strength of the compact yarn (with a nominal linear density of 40 Ne spun from Long-Staple cottons) was 17.63% higher than the conventional ring spun yarn, while for the Extra-fine carded yarns spun from Extra-Long Staple varieties (it was around 7.0%). This means that, the compact spinning system is more useful for Long Staple cottons and coarse and medium counts than for the Extra Long Staple cottons and finer counts.

INTRODUCTION

More recently, the Cotton Research Institute expanded its facilities used in evaluating cotton quality. This included a new spinning mill working as semi-industrial condition to evaluate the promising new varieties before launching into commercial production, the spinning potential and performance of the commercial varieties, to help the breeder in its programs. The spinning mill currently included the dominant spinning systems i.e., Open-end rotor spinning, ring and Compact spinning.

Most of the technical advances in ring spinning aimed to improve the performance of the existing technology. Compact spinning technology has been gaining much more interest since its first commercial introduction at ITMA-Paris in

1999 and it can best be described as a modification of the basic ring frame and friction spinning technique (Fehrer's DrefRing development).

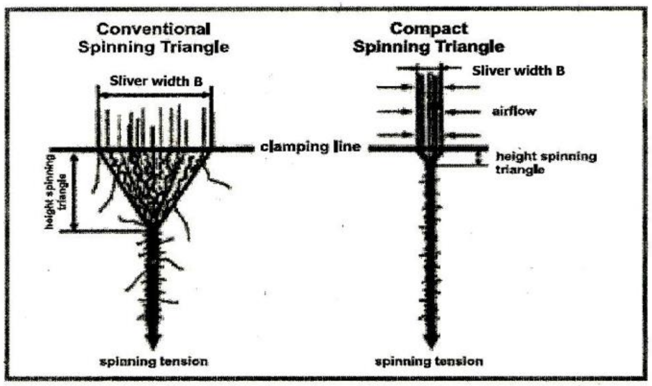
Marzoli's Olfil system can be retrofitted to its existing machines, and consists of an extra zone after the normal front rollers of the drafting system. Upon leaving the drafting system, the strand is supported on a perforated apron before passing through an extra front roller, which is belt-driven by the drafting roller. In this additional condensing zone, suction through the perforated belt creates tension in the fibers and results in a tighter yarn structure. Thus, the enhanced incorporation of the fiber characteristics into the yarn structure would allow optimal exploitation of the raw material with increased yarn strength (Oxenham 2003).

Since the compact spinning system has been introduced commercially into the market, a large number of studies have been conducted related to the short-staple and long-staple compact spinning techniques, each of which claims to offer advantages, dramatically increased production speeds, enhanced quality and reduced costs. Artzt, (2002 and 2003), Krifa and Ethridge (2003), Çelik and Kadoğlu (2003), Momir et al. (2003) and Jackowski et al. (2004) have all conducted and issued several studies comparing the properties of compact spun yarns versus classic ring-spun yarns. These studies revealed the consistent results of reduced yarn hairiness, the ability to produce yarns of enhanced strength and elongation properties even with a lesser amount of twist, which enables increased production speeds to be reached in favor of the compact spinning system.

The aim of the investigation is to find out the impact of the new spinning technology, i.e. the compact spinning system on the yarn quality parameters as compared to those of yarns spun on the conventional ring spinning system in current use in the spinning industry.

MATERIALS AND METHODS

The materials used included; (1) six Long-Staple cotton varieties grown in Upper Egypt and Delta chosen to produce 30s and 40s count yarns spun at three different twist multipliers; 3.2, 3.6 and 4.0, (2) four Extra-Long Staple cotton varieties and also, Giza 86, used to produce extra fine carded yarns i.e., 60's, 80's and 100's at a constant twist multiplier. The yarns were produced in both compact and conventional ring spinning. A standard spinning preparation and modern machinery in the experimental spinning mill, Cotton Research Institute, were used to produce conventional and compact carded yarns under comparable technological conditions on the RST1 Marzoli ring and compact spinning fitted with "Olfil System" on one frame, as shown in Graph 1 and Table 1. After the spinning trials, the physical properties of each yarn sample were measured according to ASTM (1991), and the measurement results of conventional ring yarns and compact yarns were compared to each other. Yarn evenness (CV%), hairiness and imperfections values were measured on Uster Tester 3 (the measurement length was 400 m/bobbin). Yarn tenacity (cN/Tex) and elongation at break (%) were measured on a Statimat ME with 120 breaks per sample. The HVI raw fiber data, along with the Micromat measurements were carried out on carded finisher sliver and presented in Tables 2 and 3. For the statistical analyses, the trials were designed as analysis of variance experiment with three replications.



Graph 1. Yarn formation in conventional and compact ring spinning (Artzt 2000).

Table 1. processing outline for the cottons under study.

A Ring and Compact carded yarns.

Region	Upper Egypt and Southern and Central Delta cottons						Northern Delta		
Cotton category	Long-Staple cottons						Extra Long staple cottons		
Cotton varieties	(Giza 83, Giza 90 and Giza 91)[1] (Giza 85, Giza 89 and Giza 86)[2]						Giza 45, Giza 87, Giza 88, Giza 70 and Giza 86[3]		
Roving Frame	BCX 16-A Marzoli								
Roving	0.90 hank						1.50 hank		
Ring spinning frame	RST 1 Marzoli								
Spindle speed (rpm)	16000								
Yarn count (Ne)	30			40			60	80	100
Twist multiplier	3.2	3.6	4.0	3.2	3.6	4.0	3.6		
Ring diameter (mm)	45								

[1]Upper Egypt cottons, [2]Southern and Central Delta cottons,[3] Long Staple Cotton.

Table 2. Fiber parameters for Long Staple cotton varieties.

Variety / Fiber parameters	G.83	G.90	G.91	G.85	G.89	G.86
HVI measurement UHM. (mm)	30.6	30.1	31.0	30.2	32.5	33.0
U.I. (%)	85.0	85.0	85.0	86.0	85.9	87.0
Short Fiber Index	9.3	7.9	8.3	6.4	6.5	7.0
Strength (g/tex)	35.5	35.0	36.8	38.5	42.0	45.0
Elongation (%)	7.6	7.8	7.1	6.4	7.0	7.0
Micronaire	4.5	4.1	4.2	3.9	4.5	4.4
Maturity (%)	0.92	0.94	0.91	0.91	0.97	0.94
Micromat measurement						
Fineness (mtex)	159	153	156	143	161	160
Maturity ratio	85	83	84	85	87	87

Table3. Fiber parameters for Extra Long Staple cotton varieties.

Material / Fiber parameters	G.45	G.87	G.88	G.70
HVI measurement UHM. (mm)	35.6	35. 4	35.2	35.5
U.I. (%)	86.8	87.0	86.7	87.0
Short Fiber Index	5.8	5.7	5.6	5.4
Strength (g/tex)	45.9	45.6	45.9	47.0
Elongation (%)	5.8	5.7	5.6	5.4
Micronaire	3.1	3.2	3.7	3.9
Maturity ratio	0.87	0.90	0.93	0.92
Micromat measurement.				
Fineness (mtex)	109	112	135	146
Maturity	82	85	84	82

Fiber properties of the studied cotton varieties, both Long and Extra-Long Staple categories, are presented in Tables 2 and 3. The important differences between the Long-Staple cottons were noticed for the fiber length, fiber strength and Short Fiber Index. Giza 86 which has the longest fibers among the Long-Staple category, showed also, the highest fiber strength among both Upper and Delta cotton cultivars, while, Giza 83 is of the highest S.F.I. and followed in a descending order by Giza 91 and Giza

Table 2. Fiber parameters for Long Staple cotton varieties.

Variety Fiber parameters	G.83	G.90	G.91	G.85	G.89	G.86
HVI measurement UHM. (mm)	30.6	30.1	31.0	30.2	32.5	33.0
U.I. (%)	85.0	85.0	85.0	86.0	85.9	87.0
Short Fiber Index	9.3	7.9	8.3	6.4	6.5	7.0
Strength (g/tex)	35.5	35.0	36.8	38.5	42.0	45.0
Elongation (%)	7.6	7.8	7.1	6.4	7.0	7.0
Micronaire	4.5	4.1	4.2	3.9	4.5	4.4
Maturity (%)	0.92	0.94	0.91	0.91	0.97	0.94
Micromat measurement						
Fineness (mtex)	159	153	156	143	161	160
Maturity ratio	85	83	84	85	87	87

Table3. Fiber parameters for Extra Long Staple cotton varieties.

Material Fiber parameters	G.45	G.87	G.88	G.70
HVI measurement UHM. (mm)	35.6	35. 4	35.2	35.5
U.I. (%)	86.8	87.0	86.7	87.0
Short Fiber Index	5.8	5.7	5.6	5.4
Strength (g/tex)	45.9	45.6	45.9	47.0
Elongation (%)	5.8	5.7	5.6	5.4
Micronaire	3.1	3.2	3.7	3.9
Maturity ratio	0.87	0.90	0.93	0.92
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Fiber properties of the studied cotton varieties, both Long and Extra-Long Staple categories, are presented in Tables 2 and 3. The important differences between the Long-Staple cottons were noticed for the fiber length, fiber strength and Short Fiber Index. Giza 86 which has the longest fibers among the Long-Staple category, showed also, the highest fiber strength among both Upper and Delta cotton cultivars, while, Giza 83 is of the highest S.F.I. and followed in a descending order by Giza 91 and Giza

90. Giza 45 and Giza 87 are top quality among Egyptian cottons due to their superior fiber quality specially fiber fineness, and followed in a descending order by the newer cotton variety Giza 88 and also, Giza 70.

RESULTS AND DISCUSSION

Yarn tensile properties

Means of the single yarn strength and elongation at break % are shown in Tables 4, 5, and 6. The data showed the compact spun yarns having tensile properties comparable to those of carded yarn spun on the conventional ring frame for both two cotton categories.

According to the data given in Tables 4, 5 and 6, it is interesting to note that the improvements in yarn strength appear to be greater for Long-Staple coarse yarn count than for the Extra-Long Staple especially in the Extra-fine count. These results made it clear that some fibers that were of low spinning performance in conventional ring spinning may be spun satisfactorily on the compact system. For the Long Staple cotton varieties, the breaking force or single yarn strength of the compact yarn with a nominal linear density of 40 Ne and spun on a Marzoli compact spinning machine is 17.63% higher than the conventional ring spun yarn, produced on the same machine, while the difference was around 7.0% for all the Extra-fine carded yarn spun from Extra-Long Staple varieties.

According to the yarn formation mechanism in compact spinning, i.e. the suction air seizes the fibers as they leave the front roller nipping line, condensing the fiber strand, the result is the dramatic reduction of the hairiness and better fiber alignment, and as the hairiness tends to decrease as the count becomes finer and fiber length becomes longer, the compact spinning is of more profitability for Long Staple Cottons and coarse counts than for Extra Long Staple cottons and finer counts.

Tables 4 and 5 compares the results of yarn strength obtained on the low-twist compact yarns (3.2α) versus the regular-twist (4.0α) conventional yarns spun from the Long-Staple cotton category, the compact spinning offers higher tenacity with same twist multiplier, or same tenacity with reduced twist multiplier for higher production. The difference of yarn strength and elongation at break is statistically significant. The reduction of the twist multiplier can result in an increase of the production rate; therefore, the compact technology permits higher spinning productivity while maintaining the yarn strength. These results corroborate those described in the literature, where a 19 % increase in the spinning frame production rate was reported (Krifa et al. 2002 and, Krifa and Ethridge 2003).

Table 4. Yarn strength and Elongation, compact 30 Ne vs. conventional yarns.

Y. pr.	Strength		Elongation		Strength		Elongation		Strength		Elongation	
T. M.	3.2		3.2		3.6		3.6		4.0		4.0	
S. S.	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp
Giza 83	14.91	19.61	5.6	6.2	18.71	21.84	6.1	6.6	19.38	22.66	7.0	7.5
Giza 90	15.70	18.38	5.4	6.3	17.84	19.47	6.0	6.9	18.93	21.94	5.5	6.5
Giza 91	14.73	17.51	5.4	6.5	16.36	19.39	6.6	6.9	17.48	20.26	6.7	7.4
Giza 85	18.50	21.82	6.0	6.7	19.60	23.48	6.6	6.0	22.02	24.88	6.7	7.2
Giza 89	17.68	22.41	6.0	6.7	21.45	23.41	6.6	6.6	22.58	24.58	6.7	7.3
Giza 86	18.84	22.35	5.9	7.1	22.36	24.96	6.1	6.6	23.06	25.00	6.4	7.6
L.S.D.	1.29		0.13		1.29		0.13		1.29		0.13	

T. M. Twist Multiplier, L.S.D. Least significant difference at 0.05% level.

Y.pr. yarn properties, S.S. spinning system

According to Table 6, the results present that the Giza 45 and Giza 87 yarns which are of the Extra Long-Extra fine category, were of higher tenacity either single yarn strength or elongation as compared with yarns spun from the other ELS cottons and followed in descending order by Giza 88 and Giza 70. These results were significant and hold true for both conventional ring and compact spinning. It clearly shows that the compact spinning resulted in a generally higher strength and greater elongation for cotton varieties under study.

Table 5. Yarn strength and Elongation, compact 40 Ne vs. conventional yarns.

Y. pr.	Strength		Elongation		Strength		Elongation		Strength		Elongation	
T. M.	3.2		3.2		3.6		3.6		4.0		4.0	
S. S.	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp
Giza 83	14.17	18.49	5.1	6.2	16.78	19.09	5.6	6.3	17.99	21.88	5.6	6.8
Giza 90	14.89	17.32	4.9	6.3	15.98	18.13	5.4	6.4	17.33	19.72	5.5	6.5
Giza 91	14.51	17.36	4.5	5.9	15.74	18.58	5.4	6.1	16.78	19.08	5.6	6.7
Giza 85	16.64	20.12	4.9	5.7	18.87	21.76	5.4	6.3	22.00	24.41	5.5	6.4
Giza 89	16.85	20.08	5.0	5.5	20.53	22.97	5.6	6.1	21.52	25.14	5.9	6.5
Giza 86	17.75	21.92	4.6	5.3	21.52	23.92	5.0	5.8	22.02	24.82	5.5	6.2
L.S.D.	1.33		0.14		1.33		0.14		1.33		0.14	

Table 6. Yarn strength and Elongation, compact vs. conventional different fine yarn counts.

Y. pr.	Strength		Elongation		Strength		Elongation		Strength		Elongation	
Count	60		60		80		80		100		100	
S. S.	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp
Giza 45	27.08	28.61	5.2	5.4	24.32	26.56	5.0	5.3	23.40	24.02	4.7	5.1
Giza 87	26.90	27.97	5.3	5.4	24.25	25.70	5.1	5.3	23.34	22.64	4.8	5.2
Giza 88	24.78	25.67	5.2	5.7	18.81	20.50	5.0	5.4	16.98	17.96	4.8	5.2
Giza 70	23.50	24.75	5.2	5.6	18.26	19.75	5.0	5.4	15.10	16.65	4.8	5.2
Giza 86	20.10	22.88	5.3	5.5	17.80	18.09	5.1	5.3	12.70	14.90	4.8	5.2
L.S.D.	2.40		0.10		2.40		0.10		2.40		0.10	

Giza 86 cotton spun yarns (33.0 mm UHM) showed the lowest yarn strength as compared with the other studied Extra-Long Staple cottons. The decrease in yarn strength of that cotton was more pronounced for yarns spun over 80s carded yarn with a sudden drop at the 100s count. These results could be attributed to the higher micronaire reading and low fiber length compared with the ELS cottons.

In addition to the values of strength obtained for each of ELS cotton spun with the two different processing sequences, depicts the absolute differences in the levels of this property between the conventional carded yarn and the compact yarn. A charting of the yarn strengths from each ELS cotton varieties with conventional versus compact spinning is given in Figure 3, which shows that, yarn strength was higher for carded compact yarns. On the other hand, it appears that the ability of compact spinning to compensate for use LS cotton (Giza 86) to produce the same quality of ELS yarns spun on the conventional ring spinning.

Besides yarn strength, the transmittable strength was also considered a reliable index of spinning quality for the variety and also, used to indicate the efficiency of mill processing in translating fiber strength into yarn strength. It was clear from Table 7. that compact spun yarns have an advantage over the conventional ring spun yarns in the transmittable strength, from compact spun yarns the ratio was 56.0, 48.0 and 44 while form ring spun yarns it was 53.0, 43.8 and 39 as becomes finer from 60s, 80s and 100s, respectively. Figures 1 and 2, illustrated that the transmittable strength decrease linearly with increasing yarn count for all the varieties under study.

Table 7. Transmittable fiber strength to yarn strength (%) for ELS cottons.

Cotton variety	G. 45	G. 87	G. 88	G. 70	G. 86	Mean
Ring yarns						
60s	59	59	54	50	44	53
80s	53	51	41	38	36	43.8
100s	51	49	37	30	28	39
Mean	54.3	53.0	44.0	39.3	36	
Compact yarns						
60s	62	61	56	52	50	56
80s	57	56	47	42	42	48.8
100s	52	49	45	39	35	44
Mean	57	55.3	49.3	44.3	42.3	

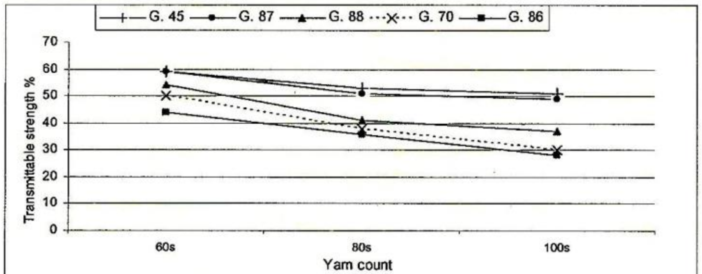

Fig. (1): Transmittable fiber strength to yarn strength inconventional yarn

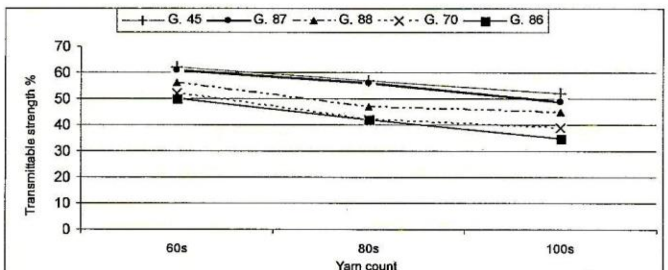

Fig. (2): Transmittable fiber strength to yarn strength in compact yarn

Yarn evenness

Analysis of variance of the yarn evenness data is summarized in Tables 8 and 9. In spite of a slight difference in the evenness data, the results indicate that, there is a significant effect of compact spinning on yarn evenness parameters although a slight differences in the evenness data. The results are similar for all yarn sizes.

When the yarn evenness of Long-Staple spun yarns were examined, coefficient of variation of both compact and conventional yarns were found to have a statistically significant difference for a significance level of $\alpha=0.05$ for both 30Ne and 40Ne conventional and compact yarn counts.

It was clear from Table 8 that the yarn evenness mean value decrease in the conventional yarns compared with compact spun yarns was 15.86, to 14.68, and 17.01 to 15.41 for the 30's and 40's yarns respectively . The Upper Egypt Long-Staple cotton varieties recorded higher mass irregularity than the Long-Staple Delta cottons due to low short fiber index, and high Uniformity Ratio for Delta cottons as shown in Table2. On the other hand, the differences of the two spinning systems in terms of mass irregularity of Extra-Long Staple spun yarns were found to be also, statistically significant for the fine yarn counts, 60 Ne; 17.93 to 16.95, 80 Ne; 21.52 to 19.57 and 100 Ne; 25.59 to 23.63, as shown in Table 9. It could be concluded that compact spinning improved yarn evenness but did not make much difference in the yarn evenness data.

Table 8. Yarn evenness, compact 30 Ne and 40 Ne vs. conventional yarns.

Count	30s		40s		30s		40s		30s		40s	
T. M.	3.2		3.2		3.6		3.6		4.0		4.0	
S. S.	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp
Giza 83	14.35	13.90	16.96	15.49	14.93	14.03	15.95	14.16	15.21	14.27	15.95	14.57
Giza 90	15.63	14.64	19.56	18.54	16.20	15.07	19.77	17.55	16.90	15.36	19.69	15.17
Giza 91	15.92	15.14	18.29	17.75	16.27	15.25	17.71	16.10	16.70	15.30	18.38	16.94
Giza 85	15.83	14.69	15.97	14.73	16.00	14.91	15.13	13.93	16.07	15.31	17.06	15.50
Giza 89	15.57	14.31	15.56	14.59	16.55	14.08	16.99	15.58	16.72	15.04	17.22	16.16
Giza 86	15.47	13.86	15.03	13.84	15.53	14.20	15.14	13.83	15.83	14.95	15.87	13.09
L.S.D.	1.59		1.55		1.59		1.55		1.59		1.55	

Table 9. Yarn evenness, compact vs. conventional different fine yarn counts.

S. S.	Ring	Compact	Ring	Compact	Ring	Compact
Y.count	60	60	80	80	100	100
Giza 45	16.67	15.80	19.16	17.45	24.29	22.80
Giza 87	16.22	16.67	19.49	18.23	23.36	23.42
Giza 88	18.91	17.14	22.33	20.70	26.06	23.25
Giza 70	19.09	17.37	23.35	20.75	27.08	23.85
Giza 86	18.76	17.78	23.30	20.75	27.19	24.83
L.S.D	1.35					

Yarn hairiness

The hairiness attachment on the Uster Tester 3 detects the rays of scattered light caused by fibers protruding from the main body of the yarn, and the amount of scattered light provides a measure of the yarn hairiness (Zellweger Uster AG, 1987).

The characteristics of the sample hairiness yarns are tabulated in Tables 10 and 11. The hairiness tests revealed an essential difference between the compact spun yarns and the standard conventional spun yarns. The Uster hairiness (H) of compact yarns is significantly lower when compared with the hairiness of conventional yarns. The results displayed that the compact yarns exhibited 25% less hairiness than the conventional ring yarns. However, the hairiness tends to decrease as the count becomes finer for yarns spun on the two spinning systems.

Table 10. Yarn hairiness, compact 30 Ne and 40 Ne vs. conventional yarns.

Count	30s		40s		30s		40s		30s		40s	
T. M.	3.2		3.2		3.6		3.6		4.0		4	
S. S.	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp	Ring	Comp
Giza 83	6.6	5.4	5.5	4.8	5.6	4.6	5.4	4.6	5.8	4.1	4.8	4.1
Giza 90	7.1	5.9	5.7	4.8	6.5	5.0	5.6	4.4	6.1	5.0	5.2	4.1
Giza 91	7.1	6.0	5.5	5.0	6.6	5.3	5.4	5.0	6.1	4.6	5.4	4.6
Giza 85	6.7	5.6	5.2	4.5	6.3	5.1	5.1	4.7	5.5	4.6	5.0	4.2
Giza 89	6.5	5.6	5.2	4.9	6.1	5.4	5.0	4.6	6.2	5.1	4.7	4.3
Giza 86	6.8	6.3	5.0	4.8	6.2	5.4	4.9	4.5	5.7	4.6	4.6	4.2
L.S.D.	0.11		0.90		0.11		0.90		0.11		0.90	

Table 11.Yarn hairiness, compact vs. conventional different fine yarn counts.

S. S.	Ring	Compact	Ring	Compact	Ring	Compact
Y.count	60	60	80	80	100	100
Giza 45	4.5	4.2	4.0	3.8	3.6	3.4
Giza 87	4.5	4.2	4.0	3.7	3.6	3.4
Giza 88	3.9	3.7	3.6	3.4	3.4	3.2
Giza 70	3.6	3.4	3.7	3.4	3.4	3.2
Giza 86	3.6	3.4	3.4	3.4	3.1	2.9
L.S.D	0.95					

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أثر نظم الغزل الحديثة على القطن المصرى

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الهدف من هذا البحث هو دراسة أثر نظم الغزل الحديثة على القطن المصـــرى، و مقارنـــة خواص الخيوط المنتجة من نظام الغزل التقليدى مع خيوط نظام الغزل المدمج وكذلك كفـــاءة نظـــام الغزل المدمج بالنسبة للأقطان المصرية.

الفكرة الاساسية لنظام الغزل المدمج عبارة عن تداخل نظام الغـــزل الاحتكـــاكى Friction spinning (DREF) مع نظام الغزل الحلقى Ring spinning فأساسيات ماكينة الغزل الحلقى كما هى، مجموعة السحب، الدبلة، الحلقة، الماردن و البوبينة. ولكن اضيف اليها سلندر مشقوق بعد الســـلندر الامامى السفلى لمجموعة السحب يتم شفط الهواء من داخله و مركب عليه أبرون جلد مثقب بحيـــث عند مرور الشعيرات بعد سحبها يحدث لها تجميع على السطح المثقب (كمـــا فـــى طريقـــة الغـــزل الاحتكاكى) وبالتالى يتلاشى مثلث البرم الذى طالما يكون موجود فى نظام الغزل الحلقى مما يؤدى الى اندماج جميع الشعيرات داخل الخيط المتكون وبالتالى يزيد الانتفاع العالى من خواص الشعيرات كما تقل تماما صفة التشعير فى الخيط وتؤدى الى تغيير فى الخواص الفزيائية والميكانيكية ولكن الى الافضل.

استخدم لهذة الدراسة ستة أصناف من مجموعة الأقطان الطويلة وهى جيزة ٨٣، جيزة ٩٠، جيزة ٩١، جيزة ٨٥ ، جيزة ٨٩ وجيزة ٨٦ غزلت على نمر ٣٠ و ٤٠ مسرح بمعاملات برم ٣,٢، ٣,٦ و ٤,٠ على كلا من نظامى الغزل الحلقى والمدمج. كما أستخدمت أربعة أصناف من طبقة فائق الطول وهى جيزة ٤٥، جيزة ٧٠ جيزة ٨٧ و جيزة ٨٨ غزلت على نمر ٦٠، ٨٠ و ١٠٠ مســـرح بمعامل برم ٣,٦.

أظهرت النتائج أن الخيوط المغزولة على ماكينة الغزل المدمج بنظام Olfil تتميز بالمتانـــة العالية وكذلك زيادة نسبة الاستطالة و زيادة معامل الانتظام للخيوط ، كما أن هناك انخفاض معنـــوى لصفة التشعير بالمقارنة مع خيوط الغزل المنتجة على نظام الغزل الحلقى التقليدى. بالنســـبة لمتانـــة الخيط المنتج من الأقطان المصرية طويلة التيلة على نمرة ٤٠ انجليزى بنظام الغزل المـــدمج كـــان اكبر بنسبة ١٧,٦٣ % من متانة الخيط المغزول على نظام الغزل الحلقى، بينما كانت نسبة الزيـــادة ٧% فقط للخيوط المغزولة على نمر ٦٠، ٨٠ و ١٠٠ من الاقطان الفائقة الطول. مما يعنى أن الفرق بين النظامين يقل بالتوجه نحو الغزل الأرفع، كما أن نظام الغزل المدمج ذو أهمية كبيـــرة بالنســـبة لطبقة الأقطان الطويلة والنمر المنخفضة عنها فى الأقطان الفائقة الطول والنمر الرفيعة .