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COMPARISON BETWEEN RING AND COMPACT SPUN FROM LONG STAPLE EGYPTIAN COTTON VARIETIES

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ABSTRACT

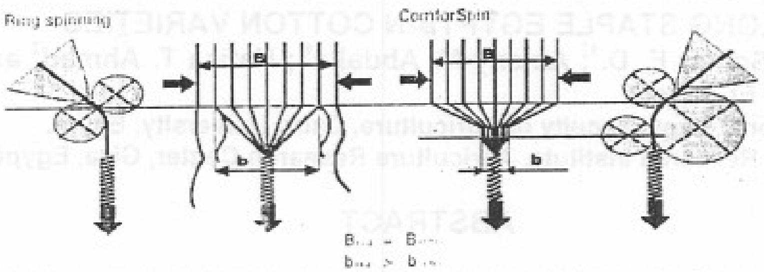
This study has been done to compare ring and compact yarns spun from Egyptian long staple varieties .six long staple cotton varieties were used as Giza 80, Giza 83, Giza 90, Giza 85, Giza 86 and Giza 89 ,chosen to produce 40's count yarn spun at three different twist multiplier;3.2, 3.6 and 4.0. The obtain data cleared that:- The compact spun yarns at low twist level had better yarn property values - thin and thick places. nep values, yarn hairiness, yarn evenness, yarn strength and elongation at break (%) - than the conventional ring spun yarns for long staple Egyptian cotton varieties in the same twist level .i.e. yarn strength of the compact yarn was 11%higher than the conventional ring spun yarn. In addition, Compact yarns reached maximum strength at a lower twist multiplier than conventional ring yarns. Increasing twist caused a reduction in the number of thin and thick places and yarn hairiness in both compact and ring yarns While Elongation at break and Strength values increased with higher twist for both spinning systems. The data revealed that, Giza 86 variety was superior in fiber strength (cN/tex) and Giza 90 variety was superior in yarn evenness and hairiness values than other varieties.

INTRODUCTION

During the last two decades, components of ring spinning machines have been greatly improved changes in drafting system; drive systems and robotics have enabled large gains in productivity, flexibility and quality. Most of the technical advances in ring spinning were aimed at improving the performances on the existing technology.

In recent years, another innovation, "Compact or condensed spinning has gained momentum because it minimizes width and height of the spinning triangle associated with ring spinning. Compact spinning technology has been gaining much more interest since its first commercial introduction at ITMA-Paris in 1999 as shown in graph 1. These spinning machines have been installed in several spinning factories all over the world consequently, in Egypt Compact spinning is a modified ring spinning process which has special advantages, and can be used in both short- and long-staple yarn spinning areas. 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.

Operating principle



Graph 1. Yarn formation in conventional and compact ring spinning

Many investigators reported about comparison between ring and compact spun system such as Celik and Kadoglu (2004) in compact yarns, fibers are uniformly oriented and joined into the yarn right after the end of the drafting arrangement. Therefore, better tenacity, elongation, and hairiness properties can be ensured. The better tenacity properties of compact spun yarn provide opportunities to work with lower twist coefficients, resulting in an increase in production rate, and also better handling properties of the end-product. Another advantage of the compact spun system is the fly and dust reduction as an effect of condensation

Compact spinning is effectively improve yarn quality and enhance its performance during the downstream processing phase .This was asserted by numerous authors (Artzt *et al.* (1995), Artzt (2000), Olbrich (2000), Stahlecker (2000), Stalder (2000) and Stalder and Rusch (2002))

Krifa *et al.* (2002) compact spinning systems offer the possibility of using cottons with shorter staple lengths to produce high-quality yarns that heretofore required long- or extra-long-staple cottons.

Ahmad (2004) in compact yarn, strength is higher by about 15% and elongation at break by about 20% compared with that of conventional yarn. Compact spun yarns also have better abrasion resistance of about 25% .fabric properties in terms of breaking strength, breaking elongation and tear strength are also better with compact yarn.

Basal and Oxenham (2006) showed that the high tenacity values of compact yarns can be attributed to the higher rate and amplitude of fiber migration in these yarns compared to those in conventional ring yarns. Another important finding was the superiority of compact yarns in terms of tensile properties is less noticeable at higher twist levels.

Krifa and Etbridge (2006) reported that compact spinning has been shown to significantly improve yarn tensile properties and reduce its hairiness. Both characteristics are crucial for yarn performance in downstream manufacturing operations.

Sanad and El-Sayed (2006) reported that the yarns spun on the compact spinning system are characterized by higher tenacity, higher elongation at break, 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 (40 Ne spun from long staple cottons) was 17.63 higher than the conventional ring spun yarn. 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. The aim of the investigation is to comparison between ring and compact yarns spun form long staple Egyptian cotton varieties.

MATERIALS AND METHODS

The present study was carried out in Cotton Research Institute, Pilot Spinning Mill, at 2005 season. six Long-Staple commercial cotton varieties namely Giza 80, Giza 83, Giza 85, Giza 86, Giza 89, and Giza 90 were selected to produce 40s count yarns spun at three different twist multipliers 3.2, 3.6 and 4.0. The yarns were produced in both compact and conventional ring spinning. The compact carded yarns processed under comparable technological conditions on the RST1 Marzoli ring and compact spinning fitted with "Olfil System" on one frame in the Pilot Spinning Mill. The processing outline presented in Table (1). Cotton fiber properties were determined according to ASTM method (1991) by using HVI Spectrum and Micromat and the data were presented in Table (2).

Table (1): processing outline for the cottons under study (A) Ring and Compact carded yarns.

Cotton category	Long-Staple cottons		
Region and Cotton varieties	Upper Egypt varieties (Giza 80, Giza 83 and Giza 90) Delta cottons varieties (Giza 85, Giza 89 and Giza 86)		
Roving Frame	BCX 16-A Marzoli		
Roving count	0.90 hank		
Ring spinning frame	RST 1 Marzoli		
Spindle speed (rpm)	16000		
Yarn count (Ne)	40		
Twist multiplier	3.2	3.6	4
Ring diameter (mm)	45		

Table (2): Fiber parameters for Long Staple cotton varieties.

Variety Fiber parameters	G.80	G.83	G.90	G.85	G.89	G.86
HVI measurement						
UHM. (mm)	31.0	30.6	30.1	30.2	32.5	33.0
U.I. (%)	85.2	85.0	85.0	86.0	85.9	87.0
Short Fiber Index	8.9	9.3	7.9	6.4	6.5	7.0
Strength (g/tex)	38.2	35.5	35.0	38.5	42.0	45.0
Elongation %	7.9	7.6	7.8	6.4	7.0	7.0
Micronaire	4.6	4.5	4.1	3.9	4.5	4.4
Maturity (%)	0.94	0.92	0.94	0.91	0.97	0.94
Micromat measurement						
Fineness (mtex)	165	159	153	143	161	160
Maturity ratio	83	85	83	85	87	87

The Statimat ME Automatic Tensile tester was used to measure single yarn mechanical properties. i.e. yarn strength (CN/Tex) and Elongation at break(%) with 120 breaks per sample, Test length was 50 cm and time to break was 5 seconds. Yarn evenness (CV %), hairiness and imperfections values were measured on Uster Tester 3 (the measurement length was 400 m/bobbin). The three factors (varieties, twist multiplier and spinning systems) were arranged in a completely randomized blocks design with three replicates. The obtained data were analyzed statistically according to procedures described by Gomez and Gomez (1984) for analysis of complete randomized blocks design (factorial analysis). L.S.D at 5% level of significance was compared to differentiate between means.

RESULTS AND DISCUSSION

Yarn properties:

Yarn strength and elongation

Data in Table (3) showed the comparison between ring spinning and compact spinning, the data recorded significant effect on yarn properties except elongation at break. Compact spinning system gave the highest mean values of yarn strength (22.30 cN/Tex) while ring spinning recorded the lowest mean values of yarn strength (19.98 CN/Tex).This means that, the compact yarns had better yarn property than the conventional ring spun yarns for Long Staple Egyptian cotton varieties. These data were harmony confirmed with Ahmad (2004), Basal and Oxenham (2006), Krifa and Etbridge (2006) and Sanad and El-Sayed (2006)

Yarn evenness

Data presented in Table (3) showed that the differences in mean values of yarn evenness, number of thin places, thick places and neps were significant due to the effect of spinning systems (ring spinning and compact spinning) ring spinning recorded the highest mean values of yarn evenness (C.V. %) of (18.05%), number of thin places(59), thick places(211) and neps (218) compared with the compact spinning, the mean values of yarn evenness(16.88) thin places(31) thick places (108), neps (115) and hairiness (4.89). this means that ,compact recorded the better imperfections values than ring spinning.

Table (3): Ring vs. compact 40 Ne, yarn properties

Spinning systems	Yarn Properties						
	Strength (C.N./ Tex)	Elongation (%)	CV (%)	Thin places	Thick places	No. of Neps	Hairiness
Ring	19.98	5.31	18.05	59	211	218	5.09
Compact	22.30	5.34	16.88	31	108	115	4.89
LSD at 0.05	0.30	N.S	0.26	4.43	9.87	9.38	0.12

Yarn hairiness

Regarding to data presented in Table (3), it could be seen that the differences in the hairiness value were significant ring spinning recorded the highest mean value(5.09)while, compact spinning recorded the lowest mean value(4.89)this means that compact spinning achieved maximum yarn hairiness reduction .

Twist multiplier

Data presented in Table (4) and demonstrated in Figure (1) showed that the effect of interaction between twist multiplier and spinning system on single yarn properties. The data obtained significant differences at 0.05 level of probability on yarn properties except number of neps. Compact yarn at4 twist multiplier recorded the highest mean values of yarn strength (24.80 CN/Tex) and elongation at break (5.5%) while ring yarn at4 twist multiplier recorded the lowest mean values of evenness and imperfection properties. Yarn strength of the compact yarn and elongation at break higher than the conventional ring spun yarn. In addition, Compact yarns reached maximum Strength at a lower twist multiplier than conventional ring yarns in the same twist multiplier. In this respect, the single yarn strength spun from Ring spinning at 4.0 twist multiplier gave the same result and higher, when spun from Compact spinning at 3.6 twist multiplier, as illustrated in Figure(1)This means that compact spinning reduced twist multiplier (10%) while maintaining same strength, reduced yarn evenness and imperfection properties. The difference between the hairiness values of compact and ring yarns decreased as twist increased.

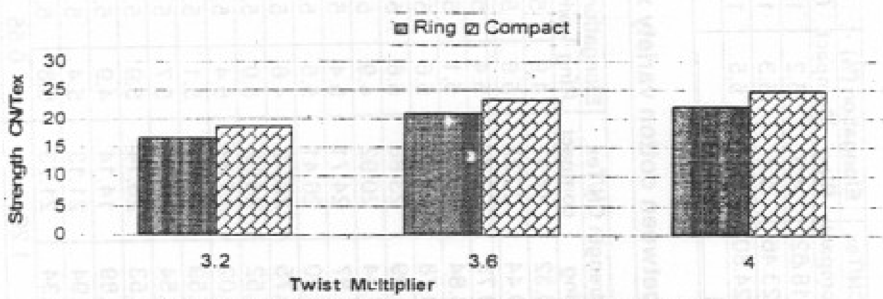


Fig.(1): Ring vs.Compact yarn strength as affected by twist multiplier

Data presented in Table (5) and demonstrated in Figure (2.3.4) showed that the interaction between Varieties, twist multiplier and spinning systems. The data recorded a significant differences effect on yarn properties. the mean values of yarn strength (cN/Tex) and elongation at break(%) were increased as twist multiplier increased from 3.2,3.6 to 4 with the compact spun yarns. while yarn evenness, yarn hairiness, number of thin places, thick places and neps were decreased when twist multiplier increased from 3.2,3.6 to 4 with the compact spun yarns for all the varieties under study.

Table (4): Interaction between twist multiplier and spinning system of single yarn properties

Twist multiplier	Yarn Properties													
	Strength CN/Tex		Elongation (%)		CV (%)		Thin places		Thick places		No. of Neps		Hairiness	
	Ring	compact	Ring	Compact	Ring	compact	Ring	compact	Ring	compact	Ring	compact	Ring	compact
3.2	16.84	18.62	4.9	5.2	19.39	17.23	97	39	224	124	259	170	5.3	4.9
3.6	20.85	23.46	5.4	5.3	17.41	16.96	50	30	219	132	216	101	5.2	5.0
4.0	22.24	24.80	5.6	5.5	17.34	16.46	32	23	191	68	180	74	4.8	4.8
LSD at 0.05	0.51		0.23		0.29		7.66		17.06		N.S		0.20	

Table (5): Interaction between cotton variety x twist multiplier x spinning system on single yarn properties

Varieties	Twist multiplier	Yarn Properties													
		Strength CN/Tex		Elongation (%)		CV (%)		Thin Places		Thick places		No. of Neps		Hairiness	
		Ring	compact	Ring	compact	Ring	compact	Ring	Compact	Ring	compact	Ring	compact	Ring	compact
Giza 80	3.2	15.32	17.47	4.9	5.1	22.33	19.20	218	70	466	202	406	351	5.4	5.3
	3.6	19.44	22.35	5.6	5.3	20.41	18.13	149	41	358	61	331	56	5.2	4.6
	4.0	20.78	22.82	5.4	5.5	17.92	17.25	21	30	205	45	157	39	4.7	4.3
Giza 83	3.2	14.84	18.49	5.1	5.2	16.96	15.49	23	5	121	92	179	67	5.5	4.9
	3.6	20.78	23.09	5.6	5.3	15.95	15.17	8	7	100	80	118	59	5.4	4.4
	4.0	21.99	23.88	5.6	5.8	15.96	14.89	16	1	109	60	78	45	4.8	4.2
Giza 85	3.2	17.64	20.92	4.9	5.4	18.98	16.74	55	22	137	82	220	131	5.2	4.6
	3.6	21.87	24.71	5.4	5.3	15.13	16.48	19	26	184	195	197	144	5.1	4.8
	4.0	23.80	26.41	5.5	5.3	17.06	15.50	30	3	158	90	175	93	5.2	4.3
Giza 86	3.2	19.75	20.48	4.6	5.3	18.03	15.84	41	8	117	86	157	97	5.0	4.8
	3.6	22.52	25.52	5.0	5.3	17.20	15.84	22	9	184	100	187	131	4.6	5.3
	4.0	24.02	27.83	5.4	5.4	16.87	15.09	18	4	178	72	134	78	4.8	5.0
Giza 89	3.2	18.59	20.05	5.1	5.0	18.56	16.59	34	18	154	141	147	149	5.2	4.9
	3.6	21.54	23.97	5.7	5.1	17.00	16.58	14	16	195	116	213	175	5.0	5.4
	4.0	22.53	26.14	5.9	5.5	17.23	16.17	16	21	209	128	203	137	4.5	5.1
Giza 90	3.2	14.89	14.14	4.9	5.3	21.47	19.54	219	111	347	139	445	225	5.7	4.8
	3.6	18.94	21.13	5.4	5.4	18.77	19.55	87	83	291	276	250	42	5.6	5.6
	4.0	20.34	21.73	5.6	5.5	19.69	19.19	91	97	283	14	335	51	5.2	5.4
LSD at 0.05		1.26		0.55		0.72		18.75		41.78		39.70		0.50	

Generally, the compact spun yarns at low twist level had better yarn property values than the conventional ring spun yarns. The data revealed that, Giza 86 variety was superior in fiber strength (cN/tex) and Giza 90 variety was superior in yarn evenness and hairiness values than other varieties (Fg. 2,3 and 4)

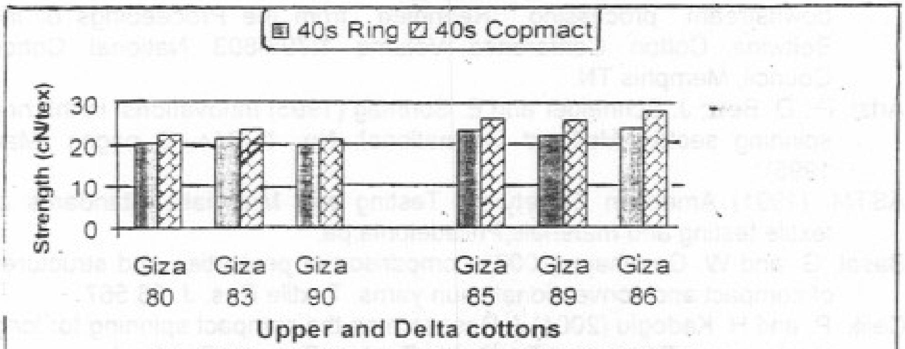


Fig (2):Ring Vs.Compact in yarn strength (cN/tex)

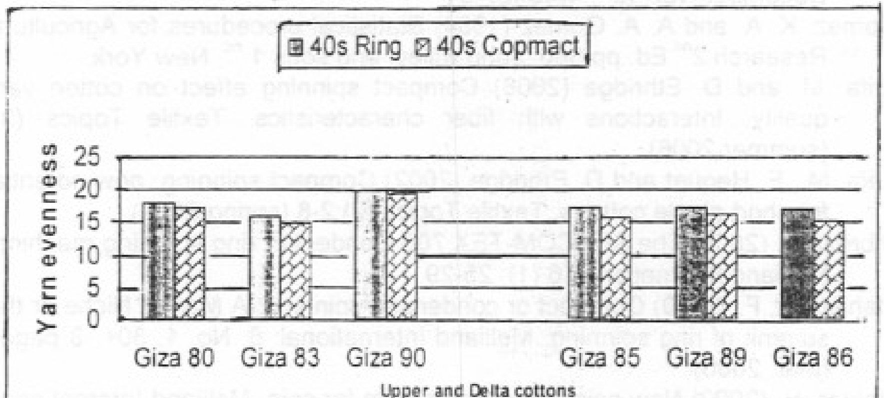
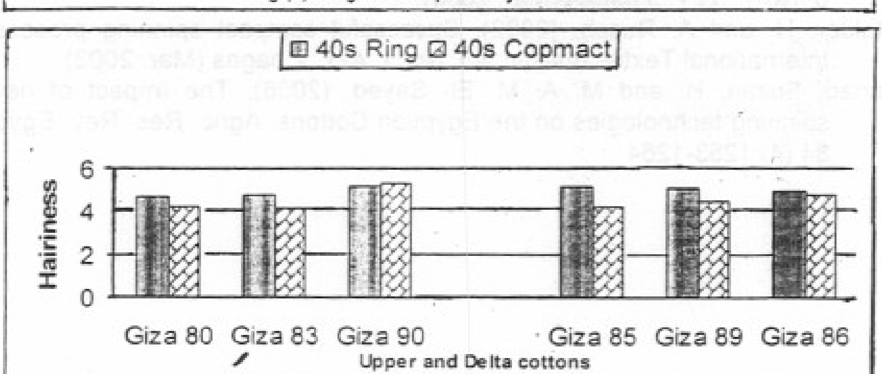


Fig (3):Ring Vs.Compact in yarn evenness



Fig(4):Ring Vs.Compact in yarn hairiness

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مقارنة بين خواص جودة الخيوط المغزولة من أقطان مصرية طويلة التيلة علـــى نظامى الغزل الحلقى والغزل المدمج

سهير عليان دسوقي عليــان[1] ، أمـــاني محمــد عبــد الله[1] ، نفيســة طــه أحمــد[2] و إيمان رشوان السيد[2]
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أجريت هذه الدراسة لمقارنة نظامى الغزل الحلقى والغزل المدمج للخيوط المغزولة من أقطان مصرية طويلة التيلة واستخدمت لهذه الدراسة ستة أصناف من القطن المصرى تمثل الأصناف طويلة التيلة وهى جيزة ٨٠، جيزة ٨٣، جيزة ٩٠، جيزة ٨٥ . جيزة ٨٩ وجيزة ٨٦ . تم غزل هذه الاصناف على نمرة ٤٠ بالترقيم الانجليزى بثلاثة معاملات برم مختلفة وهى ٣,٢، ٣,٦ و ٤,٠.

وقد أظهرت النتائج أن انخفاض معامل البرم (٣,٢) فى نظام الغزل المدمج يؤدى إلى تحسين كبير فى خواص المتانة والاستطالة والانتظام وانخفاض نسبة العيوب فى الخيط ويمكن الحصول على نفس النتائج من على نظام الغزل الحلقى ولكن على معامل برم مرتفع (٤,٠) مما يعطى ميزة نسبية كبيرة لنظام الغزل المدمج حيث تزيد الانتاجية كلما انخفض معامل البرم على نفس النمرة الغزلية. بالاضافة إلى انه يمكن الوصول لأفضل متانة للخيط على معامل برم منخفض. أن التحدى الرئيسى لنظام الغزل المدمج هو تقليل نسبة التشعير فى خواص الخيط.

أعطت الخيوط المغزولة على نظام الغزل المدمج بمعامل برم منخفض نتائج جوده مقبولة من حيث عدد المناطق الرفيعة والسميكة والعقد والتشعير ومعامل الانتظام ومتانة واستطالة الخيط المفرد بالمقارنة بالخيوط المغزولة على نظام الغزل الحلقي عند ثبات معامل البرم وكانت متانة خيوط الغزل المدمج أعلى بنسبة ١١% من الخيوط المغزولة على نظام الغزل الحلقي بالإضافة إلى إن خيوط الغزل تصل إلى أقصى متانة عند اقل معامل برم بالمقارنة بالغزل الحلقي بالإضافة إلى زيادة معامل البرم يقل من عيوب الخيط في كلا من الغزل الحلقي والغزل المدمج بينما تزيد استطالة الخيط المفرد بزيادة البرم في كلا النظامين

كما أظهرت النتائج أن الصنف جيزة ٨٦ قد أعلى متانة للشعيرات بينما سجل الصنف جيزة ٩٠ اقل انتظام وأعلى تشعير وذالك بالمقارنة بباقي الأصناف