SPINNING BEHAVIOUR OF EGYPTIAN COTTON/WASTE
BLENDS ON OPEN END SPINNING SYSTEM

BY

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Long and medium cotton wastes, either individually or blended with lower grades of cotton were blended to produce open-end yarns. The effect of blending ratios of the waste on the properties of produced yarn have been exaimend. Different blowing rooms, single and tandem card, one and two drawing passages were used to process the slivers for open-end yarns. In addition BD 200 R_c and platt sacelowell open-end spinning machines were used.

It was found that the waste of long staple egyptian cotton, containing considerable amount of good fibres is suitable for open-end processing. Blended wastes of long fibres with lower grade raw cotton slightly decrease the quality of open end yarn. Tandem card is more suitable for sliver preperation of open-end yarns produced from waste.

1. INTRODUCTION:

Since the first open end spinning machine was introduced in 1965, a huge number of studies were performed to investigate the properties of this new type of yarn. Many of these studies dealt making comparison between open end yarn and ring spun yarn properties. Another group of investigations was done to study the internal structure of open end yarn. A further group of researches trials to dealt with the study of optimum conditions either mechanically or technologically for producing economically high quality open end yarn. Some of these studies showed the effect of raw material properties
open end yarn. Because of the nature
informed, it is agreed to some extent
use finer fibres for producing it.

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The minimum number of fibres in the cross-section of open end yarn is greater than that in ring spun yarns. Since the formation of open-end yarn requires higher twist than that for ring spun yarn, shorter fibres are of significant importance.

Recently, few works have been published on the possibility of producing open end yarn using cotton waste. The egyptian cotton waste containing remarkably high portion of good fibres is suitable for processing open end yarns. The paradox of processing cotton waste by open end spinning system arises when one know that:

i) The slivers for open end spinning must be very clean.

ii) The waste contains trashes, fragments of fibres and micro-dust, these types of trashes become a source of trobules for open end spinning.

The present work deals mainly with two problems; firstly the effect of bledning ratio of cotton waste blended with raw cotton, and secondly the effect of machine aggregation on sliver preparation, namely the type of blowing room and carding machine. All yarns were produced under industrial conditions to reflect a real picture for the possibility of producing high quality of open end yarn using egyptian cotton waste.

2. MATERIAL AND FIBRE MEASURMENTS:

2.1. Material Used:

Raw cottons (Giza 66, Giza 67 and Giza 69);cotton waste" flat strips, comber noil and card slivers" which was extracted from long staple egyptian cottons "Giza 68 and Giza 70" were selected to achieve a homogenous blend as possible. Both raw cotton and cotton wastes were blended with different ratios and spun to open end yarn of different counts.

Given in Table (1) the characteristics of the various ...s of raw cottons used in the experiments. Given in Tables ... (3) the main properties of waste and cotton/waste blend ...e percent ratio of waste to raw cotton properties is ...ble (4).

Table (1): Properties of Medium and Long Staples Egyptian Cottons

Fibre Property	Type of cotton					
	Giza 66	Dendara	Giza 67	Giza 69	Giza 68	Giza70
Fibre Length:						
Effective Length(mm)	32.6	33.50	34.56	33.84	34.30	36.0
Mean length (mm)	24.3	24.05	26.30	25.82	27.60	27.2
C.V %	33.8	36.0	28.30	33.29	32.30	30.2
Short fibre % < ½"	11.7	15.20	10.20	9.34	11.0	10.8
Fibre Fineness:						
µg/inch	4.24	3.61	4.36	3.98	3.55	4.13
Fibre Strength:						
Pressely index	8.63	8.70	9.90	9.77	10.13	11.10

Table (2): Properties of cotton wastes Extracted From Egyptian cottons.

Type of cotton wastes	Fibre property					
	Micronaire reading µg/inch	Pressley index	Effective length (mm)	Mean length mm	Short fibre %	C.V %
For Giza 68						
Comber noil	3.26	8.51	33.40	22	25.0	48.7
flat strips	3.60	9.20	33.60	25	20.2	47.6
For Giza 70						
Comber noil	3.60	9.80	32.10	22	21.0	45.21
flat strips	4.04	9.96	35.0	24	13.0	45.60
For Giza 67						
Card slivers	4.30	9.60	30.0	24	10.1	35.30

Table (3): Fibre properties in Blends.

Type of Blend	Blending Ratios: raw cotton	waste: Comber noil	waste: flat strips	waste: card sliver	Fibre Property: Micronaire reading µg/inch	Pressely index	Mean length (mm)
Giza66/waste*	75	12.5	8.5	4	4.13	8.91	23.99
	50	25.0	17	8	3.99	9.53	23.00
Giza66/noil of Giza 66	75	25.0	-	-	3.94	8.10	24.61
	50	50.0	-	-	3.74	8.80	21.80
Giza66/strips of Giza 68	75	-	25	-	4.20	9.17	25.37
	50	-	50	-	4.00	8.15	24.27
Giza67/noil of Giza 68	50	50.0	-	-	3.80	9.95	24.00
Giza69/noil of Giza 70	75	25.0	-	-	4.00	9.80	24.80

* waste (noil and strips from Giza 70 + card sliver from Giza 67).

Table (4): Waste properties Relative to Mean Fibre properties.

Type of waste	Fibre property: micronaire reading µg/inch	pressly index	effective length (mm)	mean length (mm)	short fibre %	C.V%
Comber noil	0.858	0.865	0.932	0.804	2.11	1.51
Card strips	0.952	0.903	0.975	0.894	1.52	1.49
Card sliver	0.986	0.969	0.868	0.910	0.99	1.25

2.2. Fibre Measurments:

The main properties of individual components and blends were measured according to A.S.T.M.

- Fibre length distribution was determined using the sutter webb tester.

- Fibre strength measurments were carried out using pressly flat bundle strength tester at zero gauge, and,
- Fibre fineness in terms of μg/ inch using shiffeld micronaire tester.

3. YARN PRODUCTION AND MEASURMENTS:

3.1. Method:

Different types of yarns were produced to investigate the effect of both blending ratio and machine aggregation on open end yarn quality. The specifications of open end yarns produced are given in Table (5).

Table (5)

Type of Blend	Giza66/waste blend				Giza67/waste blend			Giza69/waste blend	
Blend ratio	100_C	75_C 25_W	50_C 50_W	100_W	100_C	50_C 50_W	100_W	100_C	75_C 25_W
Yarn count	The count produced was mostly Ne 14 and T/inch = 16								

The following systems were used for producing open-end yarn with different preparations:

Group I: Trützschler Blow Room/Tandem Card or single card/first or and second drawing frames/Open-end spinning machine "BD 200 Rc".

The material used for this group is Giza 67/noil blends, the yarn were processed at Dakahilia spinning mill.

Group II: Hergith Blow Room/Single card/first or and second Drawing frame/either BD200Rc or platt open end spinning machine.

The materials used for this group are Giza 66/noil, Giza 66/strips and Giza 69/noil blends. The yarns were processed at El-Mahalla spinning and weaving company.

3.2. Machine Specification:

i) Blowing Room: The blends were processed through:

1- Trützschler Line: Blending Bale opener-Automatic Hopper feeder-Step cleaner-Fine cleaner-Fine Opener and Scutcher Lap m/c.

2- Hergeith Blowing Room: Blending Bale opener-Automixer-Vertical opener-Step cleaner-porcupine beater-Hopper Feeder Two bladed beater - Kirschner beater.

ii) Carding Machines: The material was fed in the form of a lap through single or tandem card machine:

1- Single card (Tyoda). The laps were carded and N_m 0.253 (3.94 g/m) card sliver was produced at cylinder speed of 200 r.p.m.

2- Tandem card: A card Sliver was produced at cylinder speed of 300 r.p.m. and Taker-in speed was 800 r.p.m.

iii) Drawing Frame: The card sliver was processed into N_m 0.253 (3.949/m). First and second drawing sliver on ZINSER drawing frame Model 720, Using 8 doubling and 8 draft.

iv) Open-End Spinning Frame:

1- BD 200 Rc open-end machine with rotor speed of 36000 r.p.m. and combing roller speed of 6000 r.p.m.

2- Platt saco-Lowell machine, with rotor speed of 40000 r.p.m. and opening roller speed of 5000 r.p.m.

3.3. Yarn Measurments:

All yarns produced on open-end spinning machines from raw cotton, cotton wastes and cotton/waste blends were examined for:-

- Yarn count and count variation by uster Autosorter.
- Yarn strength in grams, percentage extension at break and strength variability, uster tensomatt tester was used and 200 tests per yarn was performed.
- The evenneness of slivers, yarns were measured by uster Evenneness tester, at the sametime, yarn imperfections have been measured "neps, thin and thick places/1000 meter".

4. RESULTS AND DISCUSSIONS:

4.1. Material Selection:

The main fibre properties of the card sliver wastes indicated in Table (4) compared with comber noil and card flat strips are found to be close to the properties of raw cotton.

Table (1) and (2), show that the waste which was extracted from long staple cottons has a slight lower quality than that of the raw cottons used and close to that of medium raw cottons. In general the waste and its blend have properties sufficient to produce coarser open end yarns of good quality.

4.2. Effect of Blending Ratio on open-End Yarn Properties:

(i) Yarn Strength:

It has been found previously that the open end yarns has low tenacity than that of ring spun yarns processed from the same cotton. The observed low strength of open end yarns can be attributed to poor fibre extent /1/.

Table (6) and graph (1) show the effect of blending ratio on the strength of open end yarns produced from different cotton/waste blends. It was found that when both raw cotton and wastes were blended, the strength of yarn has been slightly decreased as the proportion of cotton wastes in the blend increased. The tenacity of open end yarns produced from 100% cotton wastes and cotton/waste blends are fairly close to each other.

(ii) Yarn Extension:

The elongation of open-end yarns is usually reported to be higher than that of ring spun yarn/3/. However the conditions operating during open end spinning can affect this property. In some cases a similar elongation to that found in ring spun yarns is reported.

In the present work it was found that yarn extension for various 100% cotton is slightly higher than for 100% waste exept for 100% cotton (G67) and 100% noil of G 70.

Douglas /5/ in his work found for open end yarn of 12.5^{s} (50 tex), with twist factor 5.5 that the extension is ranging between 9.8 to 10.7%, which is considered high for the length of fibre used (from 9 to 12 mm) in comparsion with that obtained for yarns produced for longer fibres (22 to 27 mm) in the present work.

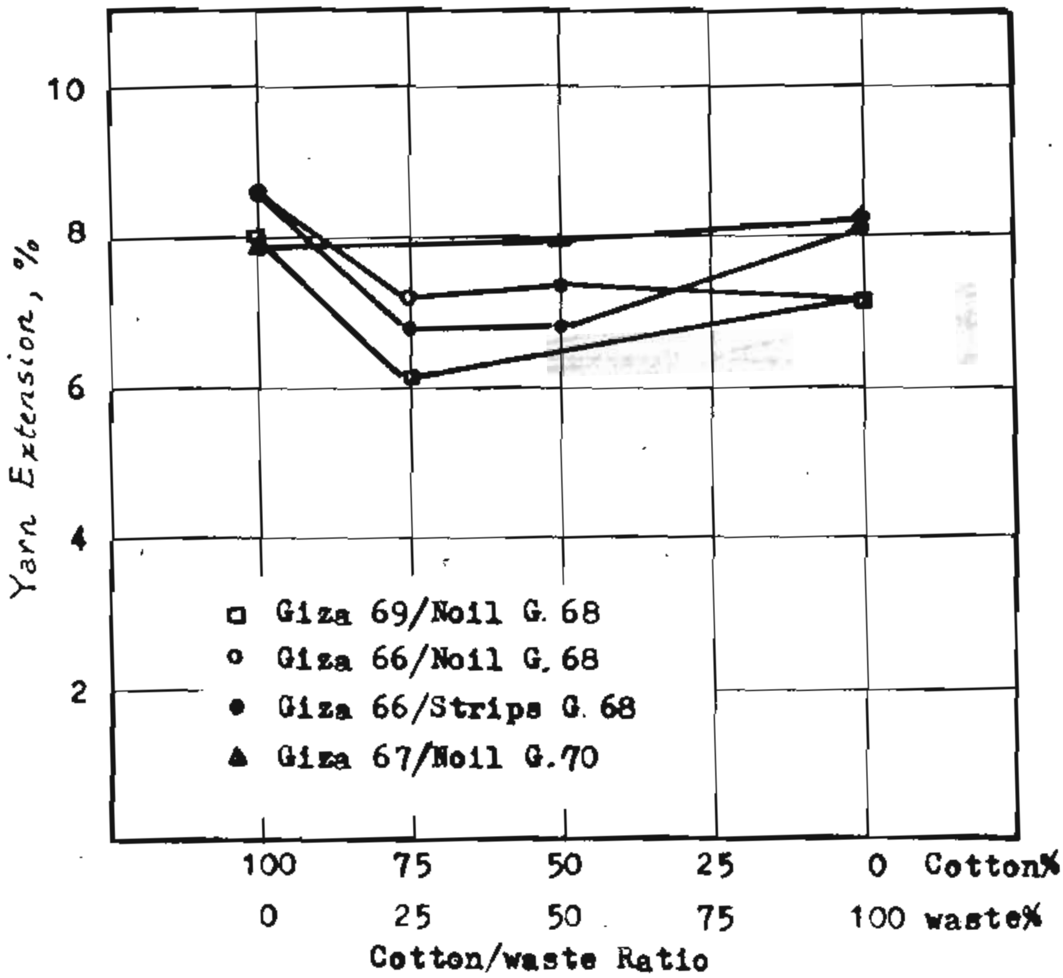

Fig. 2. Relationship between Yarn Extension and Cotton/waste Ratio

iii) Yarn Irregularity:

The distribution of fibre length and the linear density of fibres are very important factors affecting the irregularity of yarn. As expected increasing the percentage of short fibres due to blending with wastes increases irregularity.
Fig.(3) show that yarn irregularity C.V% increases as the percentage of waste increases for all types of fibres. Also, the coefficient of variation values for the yarn produced from 100% noils or its blend are higher than those produced from flat strips. Table (9) shows the imperfection (neps, thin and thick places/ 1000 m). Generally as the percent of waste increases imperfections increases. Main imperfection is nep, where the probability of nep formation increases due to the existance of higher percentage of dead and half mature fibres in the blend compared with that in the raw cotton used.

4.3. The Effect of Machine Aggregation on Open End Yarn Properties

(i) Yarn Strength:

Yarn strength and type of carding machine: Table (8) shows the results obtained by processing 100% raw cotton of various types either on single card or tandem card. The tenacity of yarns which were processed on tandem card have higher values than those processed on single card. This may be interpreted with reference/ 4/, which stated that: "The unmatched degree of fibre individualisation achieved by tandem card leads to improved drafting, facilitates trash extraction by the open-end trash eliminator and provide a smoother flow of fibres into the spinning rotor. In fact these factors contribute to improve yarn strength.

Yarn strength and Number of Drawing passages:
From Table (8) and Fig.(4), It could be concluded that for the same material the tenacity increases using double drawing passages, this due to more straighten and parallization of fibres. The results obtained indicate that yarns produced on BD 200 Rc machine have higher strength than that produced on platt open-end machine. And that both yarn have almost the same evenness, Also the ends down/1000 spinlde hrs is less for platt O.E machine than that obtained on BD 200 for the same procedure of material preparation.

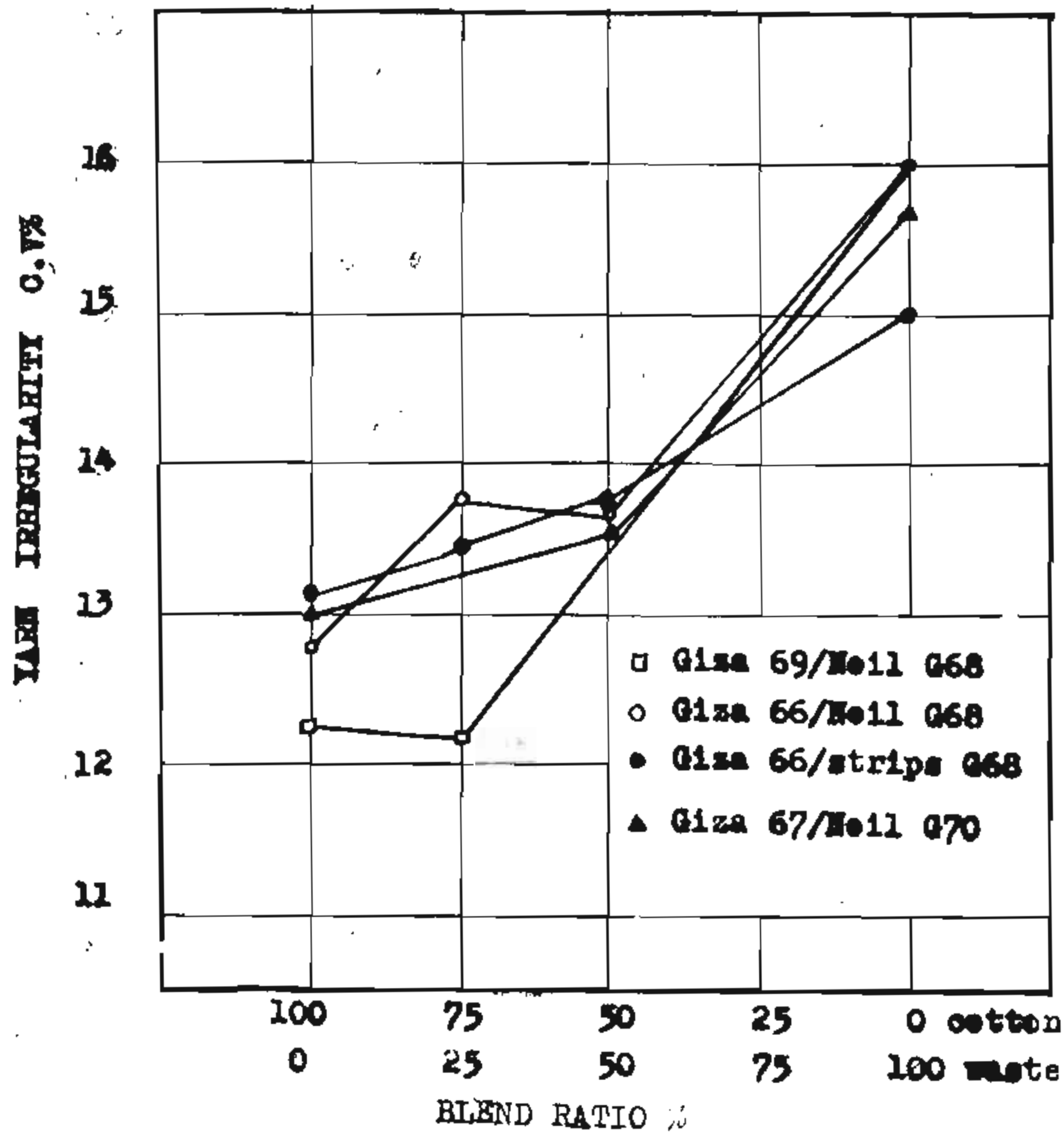

Fig.(3) The Effect of Blending Ratio On open-end Yarn Irregularity

TABLE (7) Properties of Open end yarns Spun from Cotton /waste blends produced on BD_{200} and platt O.E Spinning M/C.

Open - End Spinning M/C	BD 200 Rc M/C.					Platt Saco-lowell M/C.				
Blend	Giza 66/strips			Giza 66/Noil		Giza 66/strips			Gisa 66/Noil	
	50_c 50w	75_c 25w	100_c	75_c 25w	50_c 50w	50_c 50w	75_c 25w	100_c	75_c 25w	50_c 50w
Measures Count "Ne"	13.69	14.09	14.08	13.87	13.77	14.18	14.09	13.67	13.63	14.0
Measured T.P.I	16.10	15.95	16.85	15.75	16.17	15.65	16.60	16.95	17.55	15.82
Single end Strength (g)	524.89	508.7	534.25	538.08	518.85	466.87	466.0	499	456.6	488.8
% elongation	6.8	6.80	8.5	7.20	7.36	5.38	5.3	5.9	5.7	5.3
Yarn Tenacity (g/tex)	12.17	12.14	12.56	12.64	12.10	11.26	11.12	11.5	1054	11.64
Break Factor (C S.P)	958	1050	887	981	991	907	930	934	831	928
Lea strength C.V%	1.12	6.3	5.31	6.54	7.71	3.44	3.47	3.82	7.15	1.96
Yarn Irreguularity C.V%	13.69	13.44	12.79	13.75	14	13.53	13.88	12.88	13.63	13.21
Ends down /1000 unit Hrs	219	250	16.6	107	15.0	74	40	21	21	29

Noil and Strips were extracted from Giza 68 cotton
Nominol yarn count Ne 14 with T.P.I : 16

TABLE (8) Effect of Prepartion Systems On Open-end Yarn Characteristics

Material	Giza 67/Noil (G.70) blend								
Blend %	100c			50c/50w				100w	
Preparation system	Tandem card		single card	Tandem card				Tandem card	
	F	F/s	F	F		F/S		F	F/S
Yarn Count	12	12	12	14	24	14	24	14	14
Measured count	11.7	12	12.7	13.51	23.63	14.5	25.1	14.5	13.8
Measured T.P.I	14.3	14.5	14.5	17.47	24.2	15.42	23.2	16.3	15.7
Single end Strength (g)	598	541.2	502	457.8	257	501.5	241	447	502
C.V% of yarn Strength	12.2	8.9	9.2	11.1	11."	5.91	12.9	15.7	11.0
% elongation	7.5	7.1	6.6	8.12	8.27	751	6.34	8.45	8.3
Yarn Tenacity (g/tex)	11.84	11.0	10.79	10.90	10.28	12.32	10.24	10.56	10.6
Yarn Irregularity C.v%	13.2	11.8	13.40	13.69	15.0	12.24	13.45	16.7	15.9

F : First Drawing passage

F/S: First and second Drawing passages.

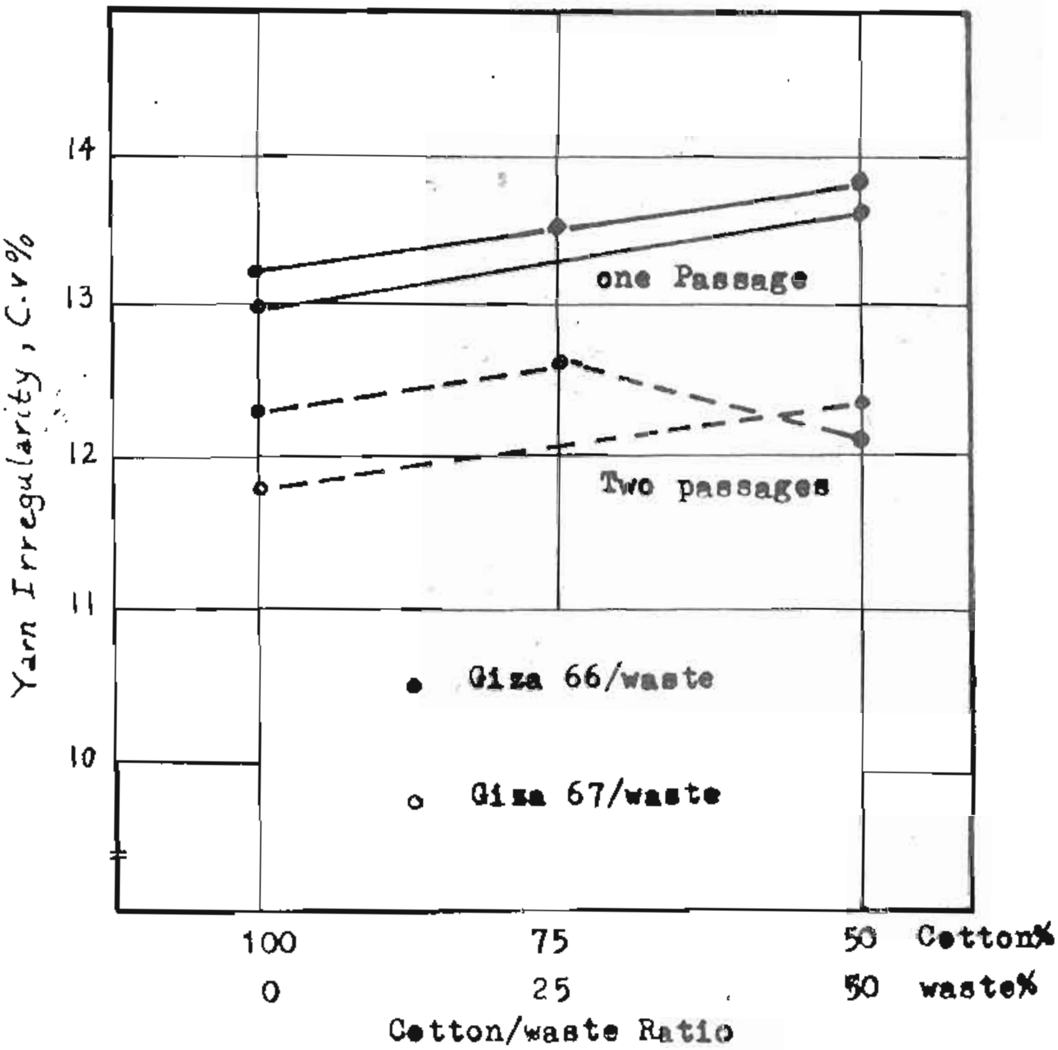

Fig. 4 . Effect of Number of Drawing Passages on Open-End Yarn Irregularity

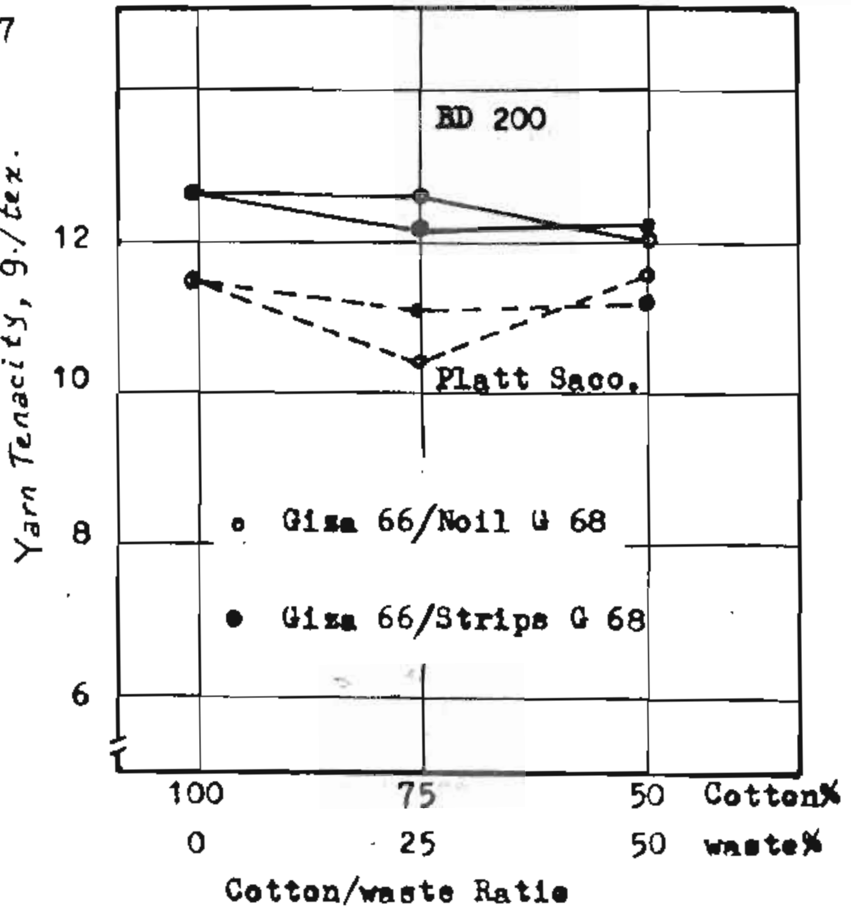

Fig.5 . Influence of Machine Type on Yarn Tenacity

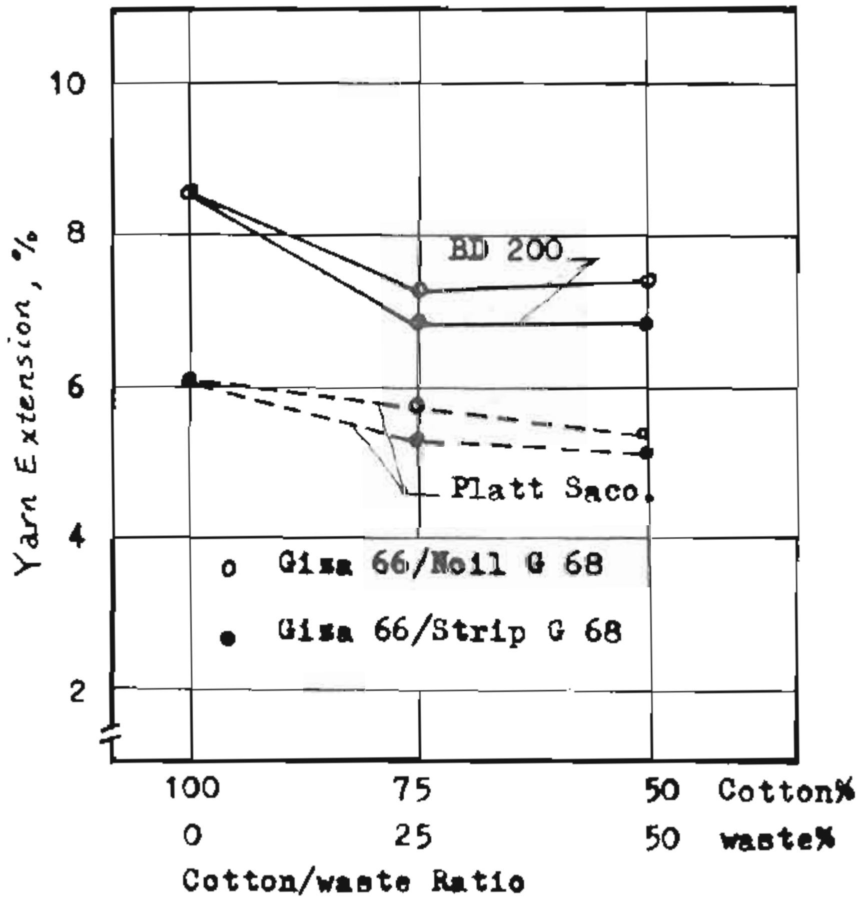

Fig. 6 . Influence of Machine Type on Yarn Extension

Table (9)- Effect of Blends and Preparation System on the Irregularity of Open-End Yarns

Preparation System	Yarn Irregularity C. V.%	Giza 66/waste blend				Giza 67/waste blend		
		100C	75C 25w	50C 50w	100w	100C	50C 50w	100w
Tandem Card with First Drawing Passage	C.V%	13.2	13.55	13.81	14.52	13.2	13.69	16
	Thin Places	15	17	24	7	4	4	16
	Thick Places	42	34	32	26	13	16	41
	Neps	346	263	358	375	24	66	234
Tandem Card with First & Second Drawing Passage	C.V%	12.3	12.63	12.04	12.6	11.79	12.3	13.6
	Thin Places	4.0	5.0	1.0	7.0	1	1	6
	Thick Places	9.0	9.0	11	11	5	10	17
	Neps	114	110	110	170	22	59	60
Single Card	C.V%	14				13.4		
	Thin Places	12				7		
	Thick Places	20				11		
	Neps	112				47		

(ii) Yarn Irregularity:

Yarn Irregularity and type of carding machine: Table (9) shows the effect of using tandem or single card on yarn irregularity, No significant differences in the yarn irregularity due to the use of ta..dem card in comparsion to the use of single card.

Yarn Irregularity and the number of Drawing passages: From Table (9) and graph (4), it could be seen that, the irregularity of the yarn processed using tandem card and double drawing passages are lower than using only one drawing passages. Also, the number of imperfections per 1000 meters are reduced. In general this is contrary to what is known in drafting theory, where the increase of short fibres produce more trouble during drafting processes. The number of doubling (2 x 8 times) used in drawing, the use of Autoleveler, the excellent cyclic doubling/6/ of fibres inside the rotor seems to have equallies the negative effect of short fibres and led to the reduction of the influence of short fibres on yarn irregularity.

5. CONCLUSIONS:

i) The waste of long staple Egyptian cotton contain high percentage of spinnable fibres, suitable for producing acceptable quality open end yarn.

ii) In the case of blends of raw cotton and waste, as the percentage of waste increases the tenacity slightly decreases.

iii) The extension of open end yarn produced from a blend of raw cotton and noil, is higher than those produced from blends of raw cotton and strips.

iv) As the percentage of wasle increases in the blend the irregularity increases.

v) The quality of yarns processed through spinning lines including tardem card was found to be higher than that processed through lines including single card.

vi) For blends centains wastes of short fibres, cyclic doubling of fibres inside the rotor improved yarn irregularity which has been resulted from drawing.

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