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PERFORMANCE OF EGYPTIAN COTTON FIBRES DURING COMBING PROCESS

دراسة سلوك بعض الأقطان المصرية اثناء عملية التمشيط

by

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خلاصة:

الهدف من هذا البحث هو دراسة تأثير نسب التمشيط المختلفة على توزيع طول الشعيرات لبعض الأقطان المصرية مثل جيزة 70 ، 75 و أجريت التجارب على ماكينة التمشيط لانتاج شرائط ممشطة عند عدة مستويات . قدرت نسب التمشيط الفعلية لجيزة 70 وكانت : 11 ، 11.8 ، 12.5 ، 14 ، 15.7 ، 16.8 ، 19.6وبالنسبة لجيزة ٧٥ كانت نسب التمشيط : 11.9 ، 13.8 ، 15.8 ، 18 ، 19.9 . تم اختبار أطوال الشعيرات للفات التمشيط ، الشرائط الممشطة وعوادم التمشيط بواسطة الفيبروجراف . تم قياس المساحة تحت منحنيات توزيع الأطوال لكل من عوادم التمشيط والشرائط الممشطة . كما تم تحليل توزيع الأطوال للفات التمشيط والشرائط الممشطة ومنها تم حساب توزيع نسبة الشعيرات المزالة أو المفقودة أثناء عملية التمشيط وكذلك احتمالية فقد الشعيرات أثناء عملية التمشيط لجميع أطوال الشعيرات. وقد أوضحت النتائج أن احتمالية فقد الشعيرات القصيرة والمتوسطة أثناء عملية التمشيط تكون عالية كما أن فقد الشعيرات يقل كلما زاد طول الشعيرات. كما أنة كلما زادت نسبة التمشيط حتى 15.7% تزيد نسبة الشعيرات المتوسط المزالة ثم تقل بزيادة نسبة التمشيط.

ABSTRACT

The aim of the present work is to study the influence of combing ratio on Egyptian cotton fibres trying to find the most suitable combing ratio for these fibres. Comber laps were prepared from G70 and G75 cotton fibres and processed on comber at different combing ratios. The actual combing ratio was determined. It was 11, 11.8, 12.5, 14, 15.7, 16.8 and 19.6% for G70 cotton fibre and 11.9, 13.8, 15.8, 18, and 19.9% for G75 cotton fibre. Fibre length parameters were measured for comber laps, comber sliver and comber noil. Area under fibre length distribution curve was measured for comber slivers and comber noil. By an analysis of comer lap and comber sliver, fibre loss distribution and the actual probability of fibre loss were calculated. Resultes showed that, fibre loss decreases as fibre length increases and the actual probability of fibre loss is maximum for short and middle length groups. As combing ratio increases up to 15.7% the fibre loss in middle length groups increases and then decreases as combing ratio increases.

1-INTRODUCTION

Morton and Nield (1) stated that the presence of trailing hooks in comber lap gives more longer fibre loss and then higher noil percent in combing process.

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Cauble (2) stated that there was a progressive decrease in comber waste as the number of drawing passages in the preparatory sequence, consisting of drawing followed by lap winding, increased from one to three.

Bogdan et.al. (5) showed that the method of preparing the lap for feeding to the comber effects both the amount of noil removal, if no changes in settings are made, and the strength and appearance of the resulting yarn.

Nutter and Slater (3) studied the effect of the direction of the presentation of hooked fibres and of drawing employed between carding and combing on comber noil, at two step-gauge settings. While Owalekar (8) stated that the direction of feed in combing is important in total noil loss only and that the fractionation obtained in combing is not much affected by the direction of feed, but it is ultimately by the total hook content in the lap.

Owalekar (8) studied the effect of hooked fibres on noil percent in the absence of top comb, and stated that without top comb, more trailing hooks give less noil percent than do more leading hooks. El-Bealy and El-Messery (9) studied the effect of top comb variables, lap weight and step-gauge setting on comber waste.

Wang and Johnson (6) reported the classification of different forms of fibre configuration possible in the pre-combed fringe as: (a) parallel fibres, (b) looped fibres, (c) hooked fibres, (d) twisted fibres and (e) neps, and reported that, of these, parallel fibres are generally believed to cause much less fibre breakage.

Owalekar (8) stated that, as noil loss in combing is due to removal of short fibres and long fibres and breakage of long fibres, studying the variation in total noil loss did not introduce enough information about the combing mechanism, so any critical study in combing should consist of a detailed analysis of these factors. Owalekar (7,8) introduced the following relationship for calculating short fibre percentage "S" effectively removed in combing below a determined boundary length:

$S = N - Ws\ (100-N1)\ /\ 100$, where, N and Ws are short fibre percent by weight in comber lap and comber sliver respectively below the boundary length and N1 is actual noil percent. Long fibre loss due to long fibre removal and long fibre breakage i.e the rest of noil was calculated as $N1 - S$.

In this work trials were carried out to study the effect combing ratio for Egyptian cotton fibres, samples of comber lap, comber noil and comber sliver were analysed to calculate effective fibre losses in various length groups, using a slightly modified method to that used by Owalekar (7,8,10).

2-EXPERIMENTAL WORK

2-1 MATERIALS USED

Two Egyptian cotton fibres, G70 and G75 were used in the present investigation. Comber laps were prepared from each of the two cottons. Each lap was processed on combing machine at different combing ratios. The actual noil percent was determined in each case as shown in table (I).

Table (I) Noil% for the different cottons

Raw material	Noil %
G70 cotton fibres	11 , 11.8 , 12.5 , 14 , 15.7 , 16.8 , 19.6
G75 cotton fibres	11.9 , 13.8 , 15.8 , 18 , 19.9

2-2 MEASURMENTS AND METHOD OF EVALUATION

Length characteristics of comber laps, comber noil and comber slivers at the selected combing ratios were determined using digital fibrograph. Fibre length properties are shown in table (II). Fibre length distributions were plotted and area under curve was measured by a planner and given in table (III)

By analysing fibre length distribution of comber lap and comber sliver, effective fibre losses due to combing in various length groups were calculated using Owalekar,s method (7,8,10) with a slight modification, were fibre % by weight was replaced by fibre % by number. Fibre losses in various length groups were plotted against the fibre length. The actual probabilities of fibre loss were also calculated in terms of ratios of effective fibre losses- to- number proportions in the lap in the corresponding length groups. Also the results were plotted against the fibre length. Regression equations and correlation coefficients between fibre loss and fibre length were calculated and listed in table (IV).

Table (II-1) Fibre length parameters of comber lap and comber sliver (G70)

Fibre length Parameter	Comber lap	Noil%						
		11	11.8	12.5	14	15.7	16.8	19.6
Span length at 2.5% (mm)	34	33.86	33.52	32.38	32.22	35.48	34.7	34.36
Span length at 50% (mm)	17.62	17.6	18	19.40	18.2	20.20	19.68	19.66
Uniformity ratio (%)	51.82	53.6	53.7	59.9	56.5	56.9	56.7	57.22
Mean length (mm)	31.43	31.39	32.19	34.99	32.59	36.59	35.55	35.51

Table (II-2) Fibre length parameters of comber waste (G70)

Fibre length Parameter	Noil%						
	11	11.8	12.5	14	15.7	16.8	19.6
Span length at 2.5% (mm)	20.74	21.66	22.16	19.72	20.0	22.84	23.14
Span length at 50% (mm)	7.70	7.7	7.66	8.14	8.10	8.18	8.28
Uniformity ratio (%)	37.13	35.55	34.56	41.28	40.50	33.81	35.78
Mean length (mm)	11.6	11.6	11.51	12.47	12.39	12.55	12.75

Table (II-3) Fibre length parameters of comber lap comber sliver (G75)

Fibre length Parameters	Comber lap	Noil%				
		11.9	13.8	15.8	18	19.9
Span length at 2.5% (mm)	29.9	29.64	28.42	28.58	29.24	30.5
Span length at 50% (mm)	15.0	17.02	17.06	16.07	17.08	17.98
Uniformity ratio (%)	50.49	57.42	60.0	56.23	58.41	58.95
Mean length (mm)	26.2	31.23	31.31	28.24	31.35	32.186

Table (II-4) Fibre length parameters of comber waste (G75)

Fibre length Parameters	Noil%				
	11.9	13.8	15.8	18	19.9
Span length at 2.5% (mm)	20.70	22.46	19.26	20.82	24.76
Span length at 50% (mm)	7.60	7.94	8.24	8.10	8.20
Uniformity ratio (%)	36.71	35.35	42.78	38.90	33.12
Mean length (mm)	11.40	12.07	12.67	12.39	12.59

Table (III-1) Area under curve for comber sliver and comber noil in sequare unit (G70)

Parameter	Noil%						
	11	11.8	12.5	14	15.7	16.8	19.6
Area under comber sliver curve (Cs)	48.4	50.6	52.4	48.8	59.5	57.1	53.7
Area under comber waste curve (Cw)	21.9	23.1	22.2	21.6	22.8	24.6	25.8
Cw/Cs%	45	46	42.4	44	38	43	48

Table (III-2) Area under curve of comber sliver and comber waste in sequare unit (G75)

Parameter	Noil%				
	11.9	**13.8**	**15.8**	**18**	**19.9**
Area under comber sliver curve (Cs)	48.4	47.2	44.7	47.5	49.4
Area under comber waste curve (Cw)	22.2	25.0	23.2	23.2	25.2
Cw/Cs%	46	53	52	49	51

3-RESULTS AND DISCUSSION

Results of experiments are shown in tables (II) and (IV) and plotted graphically in figures (1) to (7).

3-1 FIBRE LENGTH DISTRIBUTION IN COMBER WASTE

For G70 cotton fibre length distribution and area under curve are shown in fig.(1), fig.(2) and table (III-1). Where, area of combed sliver is the higher at 15.7% combing ratio and the ratio of comber noil / comber sliver is the lower. Also span length at 2.5% and mean fibre length is higher for comber sliver and lower for comber noil as shown in tables (II-1) and (II-2). At 11% and11.8% combing ratios, span length of comber sliver is reduced than that for comber lap while the mean fibre length has a little improvement.

For G75, as shown in fig.(3) and table (III-2) area under curve for comber waste is minimum at 11.9% and area under curve for comber sliver is maximum at 19.9% and percent of comber waste/comber sliver is minimum at 11.9%. From length analysis of comber sliver and comber waste shown in tables (II-3) and (II-4) it can be seen that, span length at 2.5% and mean fibre length for comber sliver is better at combing ratio 19.9% than that at 11.9%, while these variables for comber waste is worse at 19.9% than that at 11.9%.

3-2 NATURE OF FIBRE LOSS

In combing, the chance of fibre removal and the rate of fibre breakage determine the actual probability of fibre loss. The chance of fibre removal is affected by fibre length, fibre disorientation and machine elements setting. While the probability of fibre breakage is affected by many factors one of them is fibre length, the longer the fibre the greater the chance of breakage. Thus, fibres removed in combing may be short or long. From the probability curves shown in fig. (6) and (7), it can be seen that the probability of fibre removal seems to be higher for lower classes of fibre lengthes and decreases as fibre length is increases

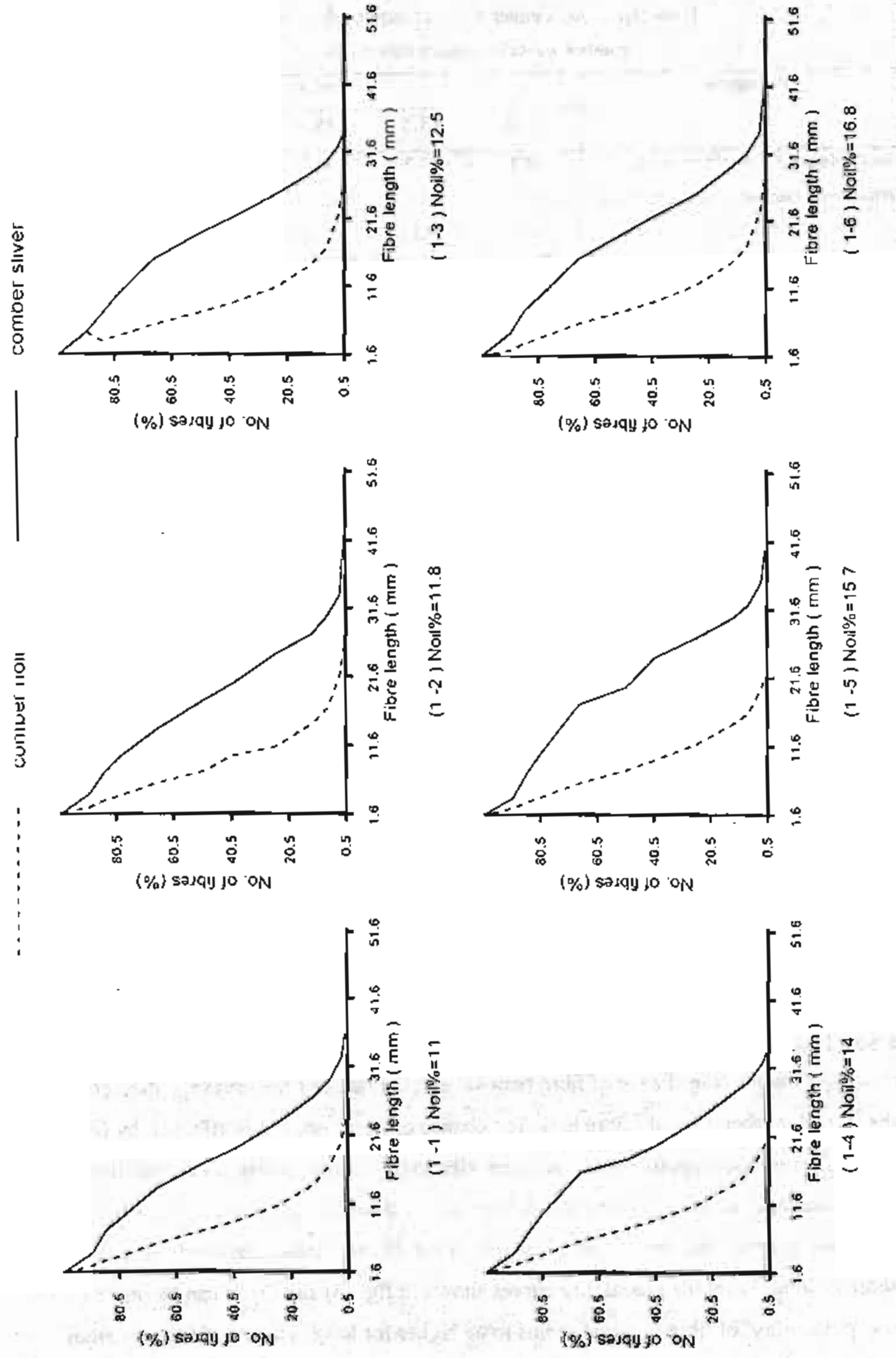
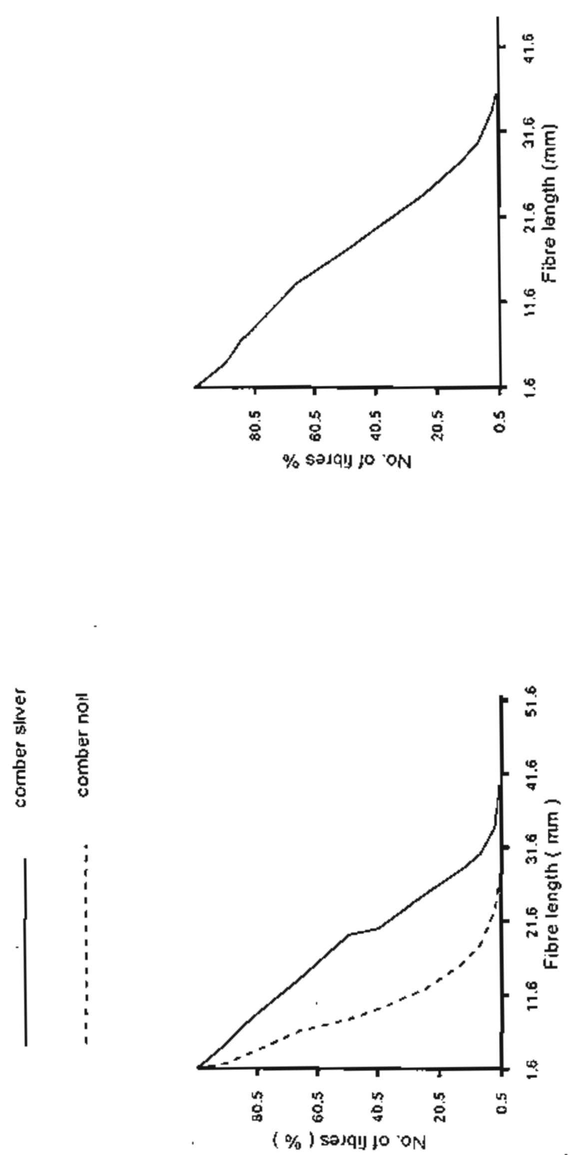


FIG. (1) FIBRE LENGTH DISTRIBUTION FOR COMBER SLIVER AND COMBER NOIL AT DIFFERENT NOIL% FOR G70 COTTON FIBRES



(2-1) Noil%=19.6

(2-2) Comber lap

FIG. (2) FIBRE LENGTH DISTRIBUTION FOR COMBER SLIVER, COMBER NOIL AND COMBER LAP FOR G70 COTTON FIBRE

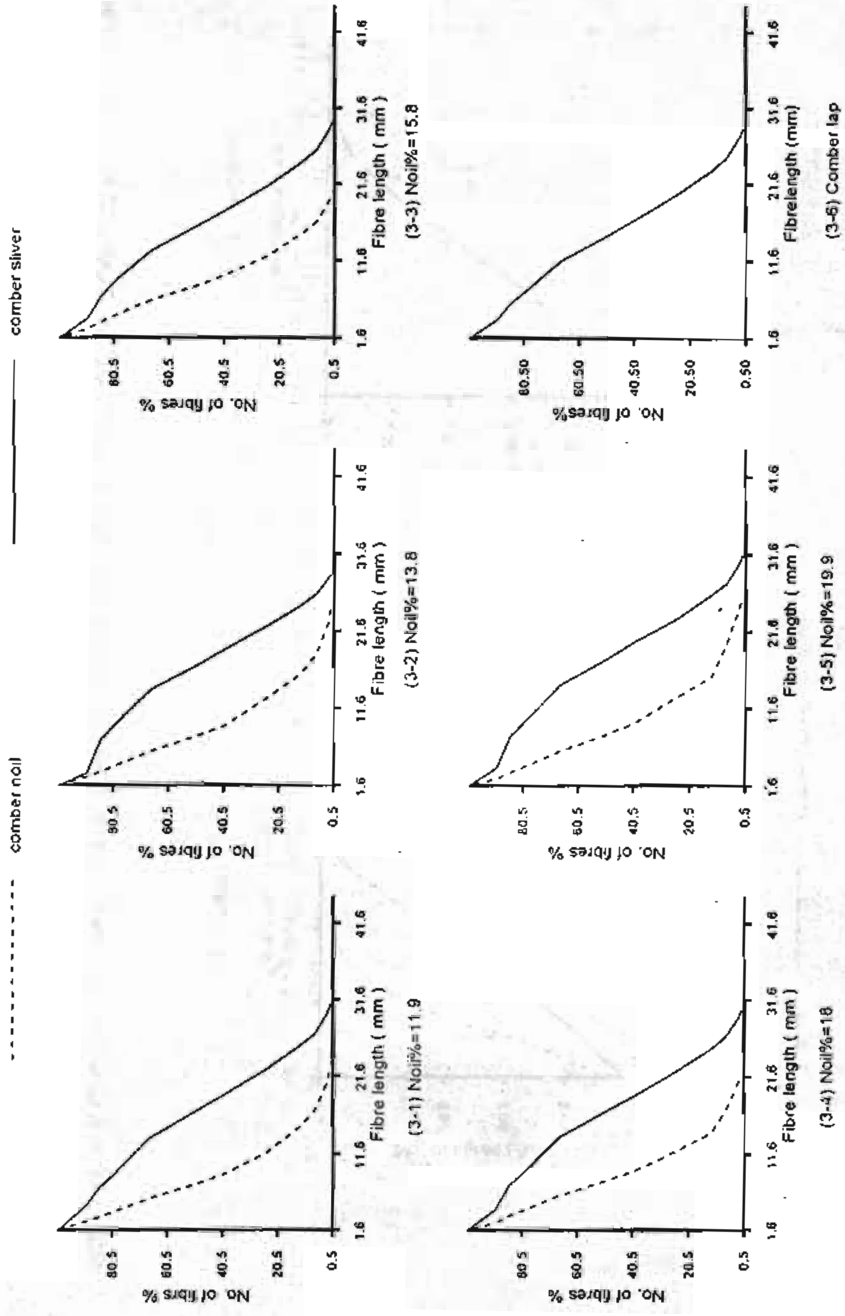


FIG.(3) FIBRE LENGTH DISTRIBUTION FOR COMBER SLIVER, COMBER NOIL AND COMBER LAP FOR G75 COTTON FIBRE

3-3 EFFECT OF FIBRE BREAKAGE ON FIBRE LOSS.

Fibre breakage effect on fibre loss the actual probability of fibre loss is towfold

(i) The actual probability of fibre loss in terms of fibre breakage:

. When a fibre break, it will be missed from its corresponding length groupand actual probability of fibre loss will increase in that length group. On the other hand the broken fibre will be either removed in noil or they will be incorporated in the comber sliver contributing to shorter length groups and will nullify part of the fibre losses in those length groups.

As shown in fig.(6) for G70 cotton fibre, actual probability of fibre loss at the longest fibre group is 0.35 for 11% and 0.12 for 14 and 19.9% noil percent. By analysing this, it can be seen that fibres in this length group did not extract in noil as seen from noil distribution in fig. (1) and (2), but subjected to breakage and contributing to shorter length groups as shown in fig.(4).

For G75 cotton fibre as shown in fig (7-3) at 15.8% noil percent, actual probability of fibre loss at the longest fibre group was high (0.58) and as shown in fig.(7-1) it is guessed that this percent was broken contributing in shorter fibre groups not lost in noil since the maximum fibre length in noil, as seen in noil distribution, was shorter than this length group. For 18% and 11.9% the actual probability at the longest length group is t 0.13 and 0.06 respectively. From fig.(7-1) it seems that fibres of this length were broken contributing in shorter length groups, as seen, at 21 to 30mm length group. For the other combing ratios there in no fibre loss at the longest fibre group.

(ii) The actual probability of fibre loss in terms of fibre straightening

Due to straightening a fibr, it will be missed from its corresponding length group and the actual probability of fibre loss in that length will increase. While the straightened fibre will contribute to longer length group nullify part of fibre loss in that length group.

For G70 cotton fibre, as shown in fig. (6-2) actual probability of fibre loss at medium length groups is maximum at 15.7% noil percent and as shown in fig.(4-2), for the same combing ratio, at longer fibre groups fibre loss is –ve i.e, fibres in these groups did not loss but it was higher in comber sliver than that in comber lap. This can be seen too from fibre length distribution (at 15.7%) in fig.(1-5) where long fibre groups were contributed in comber sliver . This means that the fibres in medium

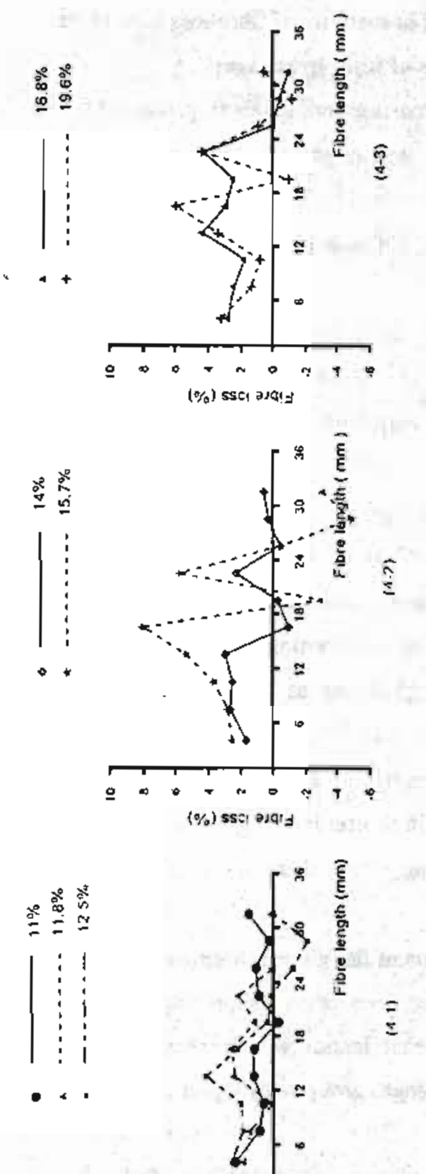


FIG.(4) FIBRE LOSS AGAINST FIBRE LENGTH (G70)

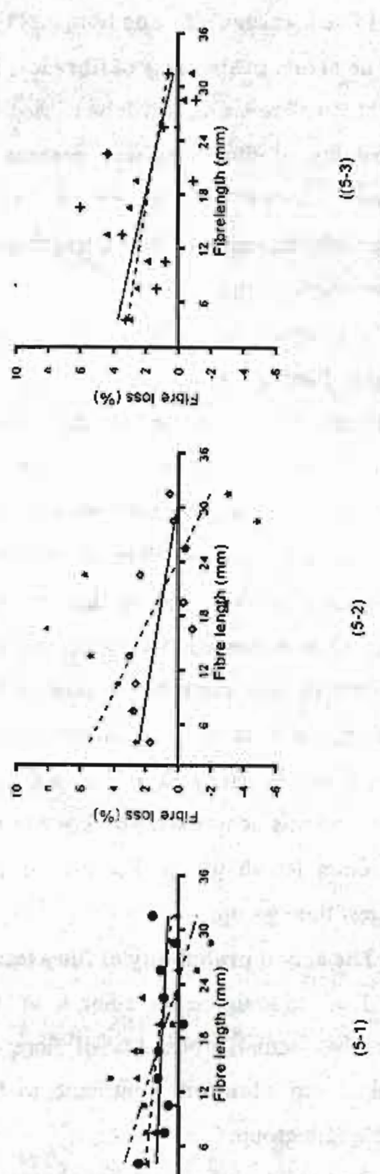


FIG.(5) CORRELATION BETWEEN FIBRE LOSS AND FIBRE LENGTH (G70)

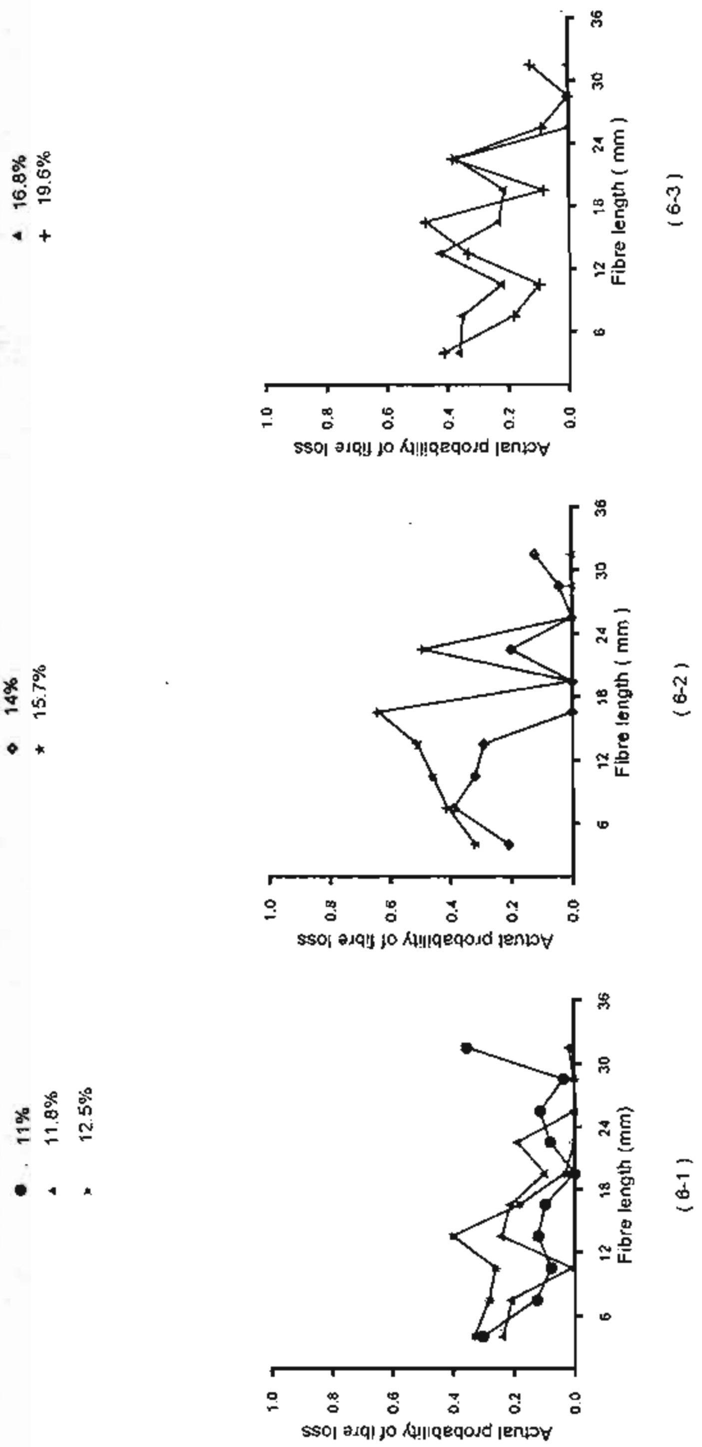
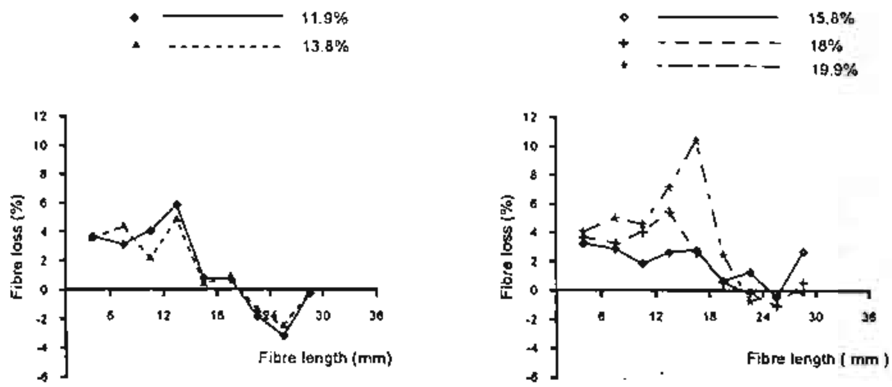
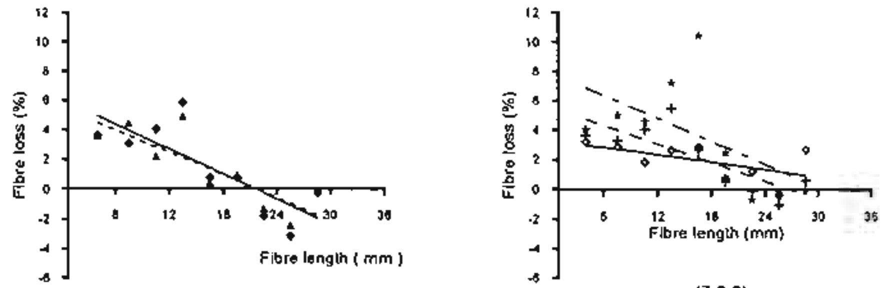


FIG.(6) ACTUAL PROBABILITY OF FIBRE LOSS AGAINST FIBRE LENGTH (G70)



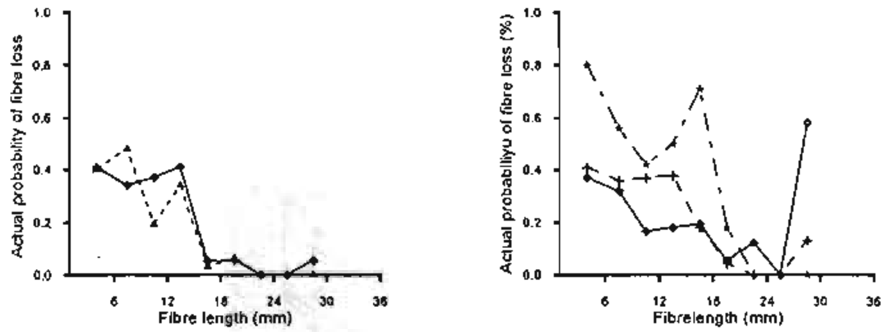
(7-1-1) (7-1-2)

FIG.(7-1) FIBRE LOSS AGAINST FIBRE LENGTH (G75)



(7-2-1) (7-2-2)

FIG.(7-2) CORRELATION BETWEEN FIBRE LOSS AND FIBRE LENGTH (G75)



(7-3-1) (7-3-2)

FIG.(7-3) ACTUAL PROBABILITY OF FIBRE LOSS AGAINST FIBRE LENGTH (G75)

FIG. (7)

length length groups were straigtened contributing to longer length groups. This can be seen too at 12.5, 16.8 and 19.6% noil percent

For G75 cotton fibre, as shown in fig.(7-1) and (7-3) there is a contribution of medium fibre groups to long fibre groups due to fibre straightening is the maximum contribution occurs at 11.9 and 13.8% noil percent. While a lower percent obtained at 18% noil percent.

3-4 CORRELATION BETWEEN FIBRE LOSS AND LENGTH DISTRIBUTION

Regression equations and correlation coefficients between fibre loss and fibre length are shown in table (IV) and plotted in fig.(5) and (7). For G70 cotton fibre it can be noticed that, in short fibre groups, maximum fibre loss was found at 15.7% noil percent and minimum fibre loss at 11% noil percent. For medium as well as long fibre groups maximum fibre loss was found at 19.6% noil percent. Maximum increase in long fibre groups as a result of combing was found at 15.7% noil percent.

Table (IV-1) Regression equation and correlation coefficient between fibre loss and fibre length (G70)

Noil%	Regression equation	r
11	Y = 1.456 - 0.0245X	-0.31
11.8	Y = 2.314 - 0 .058X	-0.488
12.5	Y = 4.246 - 0.164X	-0.787
14	Y = 2.874 - 0.089X	-0.55
15.7	Y = 7.037 - 0270X	-0.58
16.8	Y = 4.468 - 0.128X	-0.62
19.6	Y = 3.596 - 0.091X	-0.36

Table (IV-2) Regression equation and correlation coefficient between fibre loss and fibre length (G75)

Noil%	Regression equation	r
11.9	Y = 6.0495 - 0.28077X	-0.79
13.8	Y = 5.4926 – 0.25311X	-0.82
15.8	Y = 3.3195 – 0.0837X	-0.60
18	Y = 5.5678 – 0.2106X	-0.79
19.9	Y = 7.8983 – 0.2604X	-0.58

For G75 cotton fibre, as shown in table (IV-2) correlation cofficient is ranged between –0.58 and –0.82. As shown in fig. (7-2) maximum fibre loss at short, medium and long fibre groups at 19.9% noil percent (r = -0.58). At 11.9 and 13.8%

noil percent (r is -0.79 and –0.82 respectively) loss of fibres in short fibre groups is high, not the maximum, and long fibre groups were increased due to straightening shorter fibre groups as a result of combing.

4- CONCLUSION

From the experimental results and discussion the following conclusions can be drawn:

1- For Giza 70 cotton fibre, at the lower combing ratio (11,11.8) the loss of fibres takes place in short as well as in medium length groups. As combing ratio increases up to 15.7% percent of fibre loss in middle length groups increases and decreases for the longest fibre groups. This mean that fibre of middle length groups were straightened and missed from its corresponding length group and actual probability of fibre loss will be higher in that length group. However, the straightened fibres will contribute to longer length groups reducing actual probability of fibre loss in those length groups . This effect is less for combing ratios higher than 15.7%.

2- The results indicated that there is correlation between fibre loss and fibre length , where fibre loss decreases as fibre length increases

3- For G70 cotton fibre, maximum fibre loss takes place in short as well as in middle length groups at combing ratio 15.7%. Also it is evident that the percent of fibre loss in long fibre groups (fibre loss is –ve) increases at the same combing ratio.For G75 cotton fibre, fibre loss at the shortest length groups is nearly the same for the five combing ratios. While fibre loss at the middle length groups increases as combing ratio increases. Maximum increase in longest fibre groups (i.e, fibre loss –ve) occurs at lower combing ratio (11 and 13.8%).

REFERENCES

1-W.G.Morton and R.Nield, J.T.I , 44, 217, 1953.

2-D.H.Cauble, T.R.J , 28, 502, 1958.

3-W.Nutter and W.Slater, J.T.I, 50, 397, 1959.

4-W.A.Wankankar and S.N.Bhaduri, T.R.J , 32, 641, 1962.

5-J.F.Bogdan , K.C.Henery and C.H.Pan, T.R.J ,29, 741, 1959.

6-X.Wang and N.A.G.Gohnson, J.T.I ,83, 218, 1992.

7-R.G.Owalekar, T.R.J , 38, 768 , 1968.

8-R.G.Owalekar, T.R.J ,39, 893, 1969.

9-R.El-Bealy and M.El-Messery, M E J, vol.16, No.1, June, T 90, 1991.

10-R.G.Owalekar, T.R.J., 41, 697, 1971.