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Dimensional Stability of Interlock and 1x1 Rib Fabrics

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1. Introduction

The manufacture and finishing of a range of cotton interlock and rib fabrics has been described in previous reports (1, 2). In brief, the programme has included the knitting of fifteen constructions of 20 gauge interlock and sixteen of 14 gauge 1x1 rib, in each case using three yarn counts and a range of stitch lengths, and finishing them by a variety of routes.

Fabric samples were removed for testing at a number of stages during manufacture and processing. This report examines the test results concerned with dimensional stability, and an attempt is made to relate these results to fabric construction and processing conditions.

The results of two earlier series of experimental trials are included in an Appendix. These were carried out (a) at the Danish Textile Institute, as part of an earlier IIC project, and (b) at Meridian Limited, as a "curtain-raiser" for the present study, but neither should be strictly compared with the current work, as the knitting conditions and relaxation procedures may not have been sufficiently similar.

2. Processing And Sampling

A total of 252 samples have been tested during the course of the study: 126 interlock and 126 rib. Forty-five of the interlock and 54 of the rib samples were of piece-mercerised fabric, and as the mercerisation process and its effects will form the basis of a later report, only a brief summary of the data for these samples is given here.

This report therefore concentrates in detail on the dimensional stability of the remaining 81 interlock and 72 rib fabric samples. The processing details for these fabrics have already been described (2), and a summary is given below. This table includes a key to the process codes which appear in the data tables in this report.

Process Code	Process	No. of samples	
		Interlock	1x1 Rib
G	Grey	15	16
JD	Jet Dyed	15	16
JDH	Jet Dyed & Compacted (H&M)	15	16
WD	Winch Dyed	6	6
WDH	Winch Dyed & Compacted (H&M)	6	6
WB	Winch Bleached	6	6
WBT	Winch Bleached & Compacted (Tubetex)	6	6
CB	Continuous Bleached	6	-
CBT	Cont. Bleach & Compacted (Tubetex)	6	-
	Total	81	72

3. Testing

3.1. Shrinkage

The method adopted for the evaluation of dimensional stability is summarised below.

Five test specimens were taken from each fabric sample, and three measurements made on each specimen in each direction. The results given in this report are thus averages over a total of fifteen measurements.

'Fully Relaxed Structure' - IIC Laboratory Method

1. CONDITION
2. MARK fabric sample (50cm length and width)
3. WASH in automatic domestic washing machine at 60°C
4. TUMBLE DRY until dry
5. WET OUT in washing machine (Rinse cycle)
6. TUMBLE DRY until dry
7. REPEAT steps 5 and 6 three more times
8. Re-CONDITION
9. MEASURE marked distances
10. CALCULATE shrinkages (length and width)

3.2. Stitch Length

The stitch length data used in this report refer to the grey, unrelaxed, conditioned fabric measurements. Two test pieces of width 100 wales were cut from each sample, and the lengths of five yarn specimens from each piece were measured. The average of the ten yarn lengths, expressed as the length of yarn per stitch, is quoted.

3.3. Tightness Factor

The tightness factor data used in this report have been calculated using measurements of yarn count and stitch length made on the grey fabric samples after relaxation and conditioning. The method of measuring stitch length is outlined in paragraph 3.2.

Yarn counts were obtained by measuring the lengths and weights of 50 threads taken from test pieces of width 100 wales.

4. Test Results

Table 1 shows the results of stitch length measurements on the grey, unrelaxed fabrics, and tightness factors calculated from measurements of yarn count and stitch length on the grey, relaxed fabrics. These two sets of results form the bases for the comparisons between fabric shrinkage properties shown in *Figures 1 to 4*.

The results of shrinkage tests on the grey fabrics are given in *Table 2*. Area shrinkage is expressed in two ways; first, by simple addition of length and width results, and secondly, by true mathematical treatment, which of course gives slightly different results.

Tables 3 to 5 show the results of length, width and (length + width) shrinkage respectively for the interlock fabrics at various stages of processing. *Tables 6 to 8* give the corresponding figures on the rib fabrics.

The results for the main processing route - jet dyed and Bestan compacted - are examined in *Figures 1 to 4*. *Figures 1 and 2* refer to the interlock fabrics: in *Figure 1* the results are plotted

against stitch length, and in *Figure 2* against tightness factor, for each yarn count. *Figures 3 and 4* give the corresponding results on the rib fabrics.

Figures 5 to 9 compare length shrinkage data for various processing routes.

Length and width shrinkage data for the piece-mercerised fabrics are given in *Tables 9 to 11*. Discussion of these results will be included in a later report which will cover the piece-mercerisation treatment and full test data on the mercerised fabrics.

5. Discussion

Interpretation of these results can be sub-divided under three main headings.

- the effect of fabric construction on shrinkage in the grey state,
- the effect of wet processing and finishing on dimensional stability,
- comparison of processing methods and equipment.

5.1. The Effect of Fabric Construction

As yarn and fabric tensions were carefully monitored and controlled during the knitting of these fabrics, it can be considered that the results on the grey fabrics, shown in *Figures 1 to 4* accurately depict the influences of fabric construction on dimensional stability. The main factor is the stitch length. With both interlock and rib, it can be seen that increasing the stitch length also increases the length shrinkage, and reduces the width shrinkage (confirming the results of earlier work - see *Appendix*). Rather unexpectedly, perhaps, the effect on width shrinkage is greater than that on the length, so the nett effect is a reduction in area shrinkage with increasing stitch length.

There are signs of levelling out at the extremities of the stitch length ranges.

Yarn count, over the ranges examined, is seen to exert less influence than stitch length, and in the width direction particularly exerts almost no significant effect.

5.2. The Effect of Finishing

The main finishing route, and the only one to which all the fabrics were subjected, was the jet-dye, soften and Bestan compact process. The shrinkage behaviour after jet dyeing, and again after fully-finishing, is shown in *Figures 1 to 4*.

The most obvious effect of wet processing, as shown by these graphs, is to reduce the magnitude of the stitch length effect. For width shrinkage, in fact, the influence of stitch length appears to have been eliminated altogether, or even slightly reversed in the case of the fully-finished interlock.

The degree of "flatness" of the curves for the finished fabrics may be regarded as the effectiveness of the control operations during processing, which had as their objective the attainment of pre-determined targets, for interlock not more than 5% residual length shrinkage, 10% width; for rib, 5% length, 8% width. On the whole, the width targets were achieved but the length targets were not.

5.3. Comparisons Between Processing Routes

The main comparisons which may be made are shown in *Figures 5 to 9*. They have been limited to an examination of the length shrinkage data, although the width shrinkage results are, of course, given in *Table 4* (interlock) and *Table 5* (rib).

Figure 5 compares interlock dyed in the jet and in the winch, and *Figure 6* shows a similar comparison made on the rib fabrics. It is unfortunately clear from these charts that the Bestan machine was not at the time carrying out its function of reducing length shrinkage, to a satisfactory degree, and so any conclusions drawn from these results can only be tentative.

At the dyeing stage, the jet dyed interlock is more stable in length than the corresponding winch dyed fabric. Results on the rib indicate a similar conclusion. At the fully-finished stage, the jet dyed interlock is still the more stable whereas, in the case of the rib fabrics, the winch dyed fabrics appear to be superior.

An examination of the processing measurements reported earlier (2) gives a possible clue to the cause of these variations. At the previous stage (Airtex soften, Pegg dry), the jet-dyed interlock had been processed wider than the corresponding winch-dyed fabrics; in the case of the rib fabrics, the winch-dyed samples were processed wider. A wider fabric presentation to the Bestan would be expected to give a better result.

Figure 7 compares the winch-bleached and continuously-bleached fabrics. At the bleached stage, the winch-processed fabrics are slightly better, but after finishing the Tube-Text compactor has done its job and the process differences are insignificant. The tighter stitch lengths give slightly better stability.

Finally, *Figures 8 and 9* compare the two winch-based processes for interlock and rib respectively. The main effect shown by these charts is the difference between the two stabilising treatments, and it should perhaps be noted that the Bestan machine was overhauled after these trials had been completed, and is said now to be giving much better results.

6. Conclusions

At this stage, conclusions must be tentative, and should perhaps not be set down on paper. Wearer trials are about to begin, and when these are completed, the results presented in this report can be set fully into context.

REFERENCES

1. J.T. Eaton, Research Record No. 83
2. R.D. Leah, Research Record No. 94

Table 1

IIC/MERIDIAN JOINT PROJECT 1978

Grey Fabrics.		Stitch Lengths and Tightness Factors.			
SAMPLE IDENTIFIER	--Interlock--		SAMPLE IDENTIFIER	---1x1 Rib---	
	St.L.	T.F.		St.L.	T.F.
I34/307	3.05	13.7	R26/267	2.702	17.63
I34/324	3.261	12.99	R26/285	2.855	16.53
I34/340	3.425	12.31	R26/306	3.115	15.3
I34/359	3.608	11.8	R26/326	3.339	14.78
I34/377	3.767	11.02	R26/350	3.55	13.5
I38/307	3.1	12.98	R30/267	2.717	16.43
I38/324	3.248	12.45	R30/285	2.892	15.33
I38/340	3.519	11.63	R30/306	3.1	14.19
I38/359	3.613	11.44	R30/326	3.306	13.34
I38/377	3.705	10.74	R30/350	3.574	12.5
I42/307	3.046	12.23	R34/248	2.505	16.52
I42/324	3.229	11.46	R34/267	2.692	15.19
I42/340	3.457	11.2	R34/285	2.883	14.42
I42/359	3.576	10.58	R34/306	3.103	13.55
I42/377	3.819	10.27	R34/326	3.348	12.6
			R34/350	3.57	11.65

Table 2

IIC/MERIDIAN JOINT PROJECT 1978

Grey Fabrics----Shrinkage Data.									
SAMPLE IDENTIFIER	-----Interlock-----				SAMPLE IDENTIFIER	-----1x1 Rib-----			
	Len.	Width	L+W	Area		Len.	Width	L+W	Area
I34/307	10.58	21.28	31.86	29.61	R26/267	7.85	28.72	36.57	34.32
I34/324	15.49	20.83	36.32	33.1	R26/285	12.05	22.67	34.72	31.99
I34/340	18.07	16.74	34.81	31.79	R26/306	15.31	16.11	31.42	28.96
I34/359	20.92	10.45	31.37	29.19	R26/326	17.62	13.4	31.02	28.66
I34/377	20.96	8.23	29.19	27.47	R26/350	19.36	6.39	25.75	24.52
I38/307	11.68	22.02	33.7	31.13	R30/267	10.71	26.64	37.35	34.5
I38/324	13.83	21.14	34.97	32.05	R30/285	13.65	21.83	35.48	32.51
I38/340	19.02	15.62	34.64	31.67	R30/306	17.95	16.67	34.62	31.63
I38/359	23.23	9.08	32.31	30.21	R30/326	19.62	10.37	29.99	27.96
I38/377	23.35	8.28	31.63	29.7	R30/350	20.72	4.5	25.22	24.29
I42/307	14.51	23.27	37.78	34.41	R34/248	3.71	33.93	37.64	36.39
I42/324	16	22.42	38.42	34.84	R34/267	13.24	24.79	38.03	34.75
I42/340	20.74	16.43	37.17	33.77	R34/285	16.81	20.85	37.66	34.16
I42/359	24.44	10.56	35	32.42	R34/306	19.22	14.78	34	31.16
I42/377	22.95	5.46	28.41	27.16	R34/326	21.02	5.68	26.7	25.51
					R34/350	20.04	-1.43	18.61	18.9

Table 3

IIC/MERIDIAN JOINT PROJECT 1978

INTERLOCK FABRICS Length Shrinkage Data.

SAMPLE IDENTIFIER	-----LENGTH SHRINKAGE %-----								
	JD	WD	WB	CB	JDH	WDH	WBT	CBT	
I34/307	14.24	*	*	*	12.98	*	*	*	
I34/324	18.32	*	*	*	15.61	*	*	*	
I34/340	16.96	20.91	21.02	26.08	18.4	19.29	9.55	10.34	
I34/359	19.38	*	*	*	19.71	*	*	*	
I34/377	18.31	22.44	22.55	28.28	16.9	21.52	12.61	12.97	
I38/307	15.08	*	*	*	15.36	*	*	*	
I38/324	17.24	21.39	22.03	25.48	16.61	15.83	10.8	11.76	
I38/340	20.09	*	*	*	17.54	*	*	*	
I38/359	20.91	22.84	23.9	27.57	21.14	19.9	13.6	13.23	
I38/377	22.71	*	*	*	20.97	*	*	*	
I42/307	16.59	21.64	22.9	24.41	16.69	18.57	9.65	11.56	
I42/324	19.4	*	*	*	18.67	*	*	*	
I42/340	19.52	22.47	23.71	27.23	18.96	19.67	13.05	14.85	
I42/359	20.23	*	*	*	20.12	*	*	*	
I42/377	20.84	*	*	*	21.77	*	*	*	

Table 4

IIC/MERIDIAN JOINT PROJECT 1978

INTERLOCK FABRICS Width Shrinkage Data.

SAMPLE IDENTIFIER	-----WIDTH SHRINKAGE %-----								
	JD	WD	WB	CB	JDH	WDH	WBT	CBT	
I34/307	7.71	*	*	*	10.61	*	*	*	
I34/324	7.47	*	*	*	8.42	*	*	*	
I34/340	7.56	7.18	7.58	4.83	7.76	8.13	8.84	11.33	
I34/359	8.1	*	*	*	8.77	*	*	*	
I34/377	9.51	6.94	8.45	3.48	14.06	8.79	8.85	12.56	
I38/307	9	*	*	*	8.41	*	*	*	
I38/324	8.18	6.55	8.82	6.05	9.12	10.48	8.49	10.76	
I38/340	7.19	*	*	*	10.84	*	*	*	
I38/359	5.82	7.84	8.06	4.25	10.24	10.51	8.52	12.11	
I38/377	7.5	*	*	*	12.4	*	*	*	
I42/307	7.28	7.86	8.62	7.84	8.35	7.95	8.68	9.8	
I42/324	8.56	*	*	*	9.27	*	*	*	
I42/340	6.69	7.46	8.25	7.44	12.3	11.19	7.66	9.52	
I42/359	6.83	*	*	*	13.45	*	*	*	
I42/377	7.68	*	*	*	13.64	*	*	*	

Table 5

IIC/MERIDIAN JOINT PROJECT 1978

INTERLOCK FABRICS "Area"(Length+Width) Shrinkage Data.

SAMPLE IDENTIFIER	"AREA"(L+W)				SHRINKAGE %			
	JD	WD	WB	CB	JDH	WDH	WBT	CBT
I34/307	21.95	*	*	*	23.59	*	*	*
I34/324	25.79	*	*	*	24.03	*	*	*
I34/340	24.52	28.09	28.6	30.91	26.16	27.42	18.39	21.67
I34/359	27.48	*	*	*	28.48	*	*	*
I34/377	27.82	29.38	31	31.76	30.96	30.31	21.46	25.53
I38/307	24.08	*	*	*	23.77	*	*	*
I38/324	25.42	27.94	30.85	31.53	25.73	26.31	19.29	22.52
I38/340	27.28	*	*	*	28.38	*	*	*
I38/359	26.73	30.68	31.96	31.82	31.38	30.41	22.12	25.34
I38/377	30.21	*	*	*	33.37	*	*	*
I42/307	23.87	29.5	31.52	32.25	25.04	26.52	18.33	21.36
I42/324	27.96	*	*	*	27.94	*	*	*
I42/340	26.21	29.93	31.96	34.67	31.26	30.86	20.71	24.37
I42/359	27.06	*	*	*	33.57	*	*	*
I42/377	28.52	*	*	*	35.41	*	*	*

Table 6

IIC/MERIDIAN JOINT PROJECT 1978

1x1 RIB FABRICS Length Shrinkage Data.

SAMPLE IDENTIFIER	LENGTH			SHRINKAGE %		
	JD	WD	WB	JDH	WDH	WBT
R26/267	10.94	*	*	13.7	*	*
R26/285	12.51	*	*	15.18	*	*
R26/306	14.04	15.89	16.84	15.76	11.99	6.96
R26/326	16.92	*	*	16.21	*	*
R26/350	15.64	17.92	19.63	16.42	14.46	7.6
R30/267	13.77	*	*	15.07	*	*
R30/285	15.26	15.42	16.1	16.27	12.95	6.29
R30/306	16.1	*	*	17.56	*	*
R30/326	17.06	17.82	21.64	18.03	15.93	6.03
R30/350	18.04	*	*	19.19	*	*
R34/248	13.58	*	*	15.47	*	*
R34/267	14.61	14.65	16.71	16.7	13.13	3.9
R34/285	15.1	*	*	17.35	*	*
R34/306	16.37	15.49	19.5	19.37	14.75	8.68
R34/326	15.31	*	*	18.54	*	*
R34/350	18.49	*	*	20.49	*	*

Table 7

IIC/MERIDIAN JOINT PROJECT 1978

SAMPLE IDENTIFIER	1x1 RIB FABRICS			Width Shrinkage Data.		
	JD	WD	WB	JDH	WDH	WBT
R26/267	6.05	*	*	4.26	*	*
R26/285	7.14	*	*	4.93	*	*
R26/306	5.76	0.99	3.21	7.97	9.8	4.46
R26/326	5.13	*	*	5.37	*	*
R26/350	6.04	0.95	1.85	5.65	17.38	6.93
R30/267	5.26	*	*	3.69	*	*
R30/285	5.69	4.11	4.25	6.35	8.61	7.73
R30/306	7.02	*	*	5.98	*	*
R30/326	6.31	1.62	7.86	2.08	11.12	8.14
R30/350	6.73	*	*	5.97	*	*
R34/248	4.33	*	*	4.65	*	*
R34/267	6.07	5.57	4.64	6.9	8.43	7.28
R34/285	4.79	*	*	6.83	*	*
R34/306	8.95	7.5	1.97	3.67	12.26	4.88
R34/326	7.43	*	*	1.56	*	*
R34/350	7.98	*	*	3.57	*	*

Table 8

IIC/MERIDIAN JOINT PROJECT 1978

SAMPLE IDENTIFIER	1x1 RIB FABRICS			"Area" (Length+Width) Shrinkage		
	JD	WD	WB	JDH	WDH	WBT
R26/267	16.99	*	*	17.96	*	*
R26/285	19.65	*	*	20.11	*	*
R26/306	19.8	16.88	20.05	23.73	21.79	11.42
R26/326	22.05	*	*	21.58	*	*
R26/350	21.68	18.87	21.48	22.07	31.84	14.53
R30/267	19.03	*	*	18.76	*	*
R30/285	20.95	19.53	20.35	22.62	21.56	14.02
R30/306	23.12	*	*	23.54	*	*
R30/326	23.37	19.44	29.5	20.11	27.05	14.17
R30/350	24.77	*	*	25.16	*	*
R34/248	17.91	*	*	20.12	*	*
R34/267	20.68	20.22	21.35	23.6	21.56	11.18
R34/285	19.89	*	*	24.18	*	*
R34/306	25.32	22.99	21.47	23.04	27.01	13.56
R34/326	22.74	*	*	20.1	*	*
R34/350	26.47	*	*	24.06	*	*

Table 9

IIC/MERIDIAN JOINT PROJECT 1978

INTERLOCK FABRICS Length & Width Shrinkage Data on Mercerised Samples

SAMPLE IDENTIFIER	LENGTH SHRINKAGE %				WIDTH SHRINKAGE %			
	G	M	MJD	MJDH	G	M	MJD	MJDH
I34/307	10.58	21.36	19.43	18.36	21.28	-11.06	5.8	4.66
I34/324	15.49	23.93	19.51	18.86	20.83	-13.11	6.01	2.86
I34/340	18.07	25.28	20.22	19.59	16.74	-13.87	9.08	4.9
I34/359	20.92	26.85	21.86	21.12	10.45	-16.7	7.3	4.89
I34/377	20.96	30.6	22.96	23.9	8.23	-26	5.94	3.68
I38/307	11.68	23.49	19.01	18.06	22.02	-15.35	6.52	3.74
I38/324	13.83	25.06	20.54	19.45	21.14	-16.44	6.23	4.26
I38/340	19.02	26.49	21.57	20.09	15.62	-17.53	4.13	5.89
I38/359	23.23	27.91	21.89	19.84	9.08	-17.86	8.62	6.41
I38/377	23.35	29.44	22.7	20.33	8.28	-20.9	8.56	5.46
I42/307	14.51	22.05	18.55	15.88	23.27	-16.81	4.77	5.58
I42/324	16	26.17	20.22	17.84	22.42	-18.56	6.31	4.86
I42/340	20.74	25.46	20.81	22.51	16.43	-18.87	7.1	4.87
I42/359	24.44	29.19	20.35	20.33	10.56	-24.98	7.09	6.18
I42/377	22.95	30.45	22.21	18.99	5.46	-23.8	5.48	8.03

Table 10

IIC/MERIDIAN JOINT PROJECT 1978

1x1 RIB FABRICS Length & Width Shrinkage Data on Mercerised Samples.

SAMPLE IDENTIFIER	LENGTH SHRINKAGE %				WIDTH SHRINKAGE %			
	G	M	MJD	MJDH	G	M	MJD	MJDH
R26/267	7.85	14.16	14.44	12.26	28.72	-3.66	7.42	2.8
R26/285	12.05	17.72	16.16	12.69	22.67	-6.31	4.85	2.8
R26/306	15.31	18.96	16.84	*	16.11	-7.22	3.19	*
R26/326	17.62	22.22	19.11	18.29	13.4	-9.84	4.66	-0.24
R26/350	19.36	26.16	21.94	*	6.39	-13.83	4.23	*
R30/267	10.71	17.36	16.35	12.96	26.64	-6.43	6.11	3.57
R30/285	13.65	17.71	17.51	*	21.83	-6.9	6.91	*
R30/306	17.95	21.92	19.85	17.4	16.67	-10.61	4.27	2.16
R30/326	19.62	23.68	20.29	*	10.37	-13.63	6.48	*
R30/350	20.72	30.62	22.72	20.72	4.5	-21.62	7.61	3.71
R34/248	3.71	15.6	15.98	10.87	33.93	-5.29	5.61	6.76
R34/267	13.24	20.39	18.1	*	24.79	-9.15	6.45	*
R34/285	16.81	21.21	17.66	15.04	20.85	-9.72	6.97	4.88
R34/306	19.22	24.81	21.35	*	14.78	-13.97	6.22	*
R34/326	21.02	30.48	22.72	19.74	5.68	-20.91	3.79	2.72
R34/350	20.04	36.2	21.81	22.92	-1.43	-34.28	8.98	1.57

Table 11

IIC/MERIDIAN JOINT PROJECT 1978

1x1 RIB FABRICS Length & Width Shrinkage Data on Mercerised Samples.

SAMPLE IDENTIFIER	----LENGTH SHRINKAGE %----				----WIDTH SHRINKAGE %----			
	G	M	MWB	MWBT	G	M	MWB	MWBT
R26/267	7.85	14.16	*	*	28.72	-3.66	*	*
R26/285	12.05	17.72	*	*	22.67	-6.31	*	*
R26/306	15.31	18.96	18.07	4.97	16.11	-7.22	5.04	6.31
R26/326	17.62	22.22	*	*	13.4	-9.84	*	*
R26/350	19.36	26.16	22.09	6.67	6.39	-13.83	7.11	8.77
R30/267	10.71	17.36	*	*	26.64	-6.43	*	*
R30/285	13.65	17.71	16.93	5.74	21.83	-6.9	9.26	5.52
R30/306	17.95	21.92	*	*	16.67	-10.61	*	*
R30/326	19.62	23.68	21.85	7.73	10.37	-13.63	4.7	2.35
R30/350	20.72	30.62	*	*	4.5	-21.62	*	*
R34/248	3.71	15.6	*	*	33.93	-5.29	*	*
R34/267	13.24	20.39	17.35	6.24	24.79	-9.15	5.84	5.39
R34/285	16.81	21.21	*	*	20.85	-9.72	*	*
R34/306	19.22	24.81	19.66	6.96	14.78	-13.97	8.25	2.85
R34/326	21.02	30.48	*	*	5.68	-20.91	*	*
R34/350	20.04	36.2	*	*	-1.43	-34.28	*	*

Figure 1

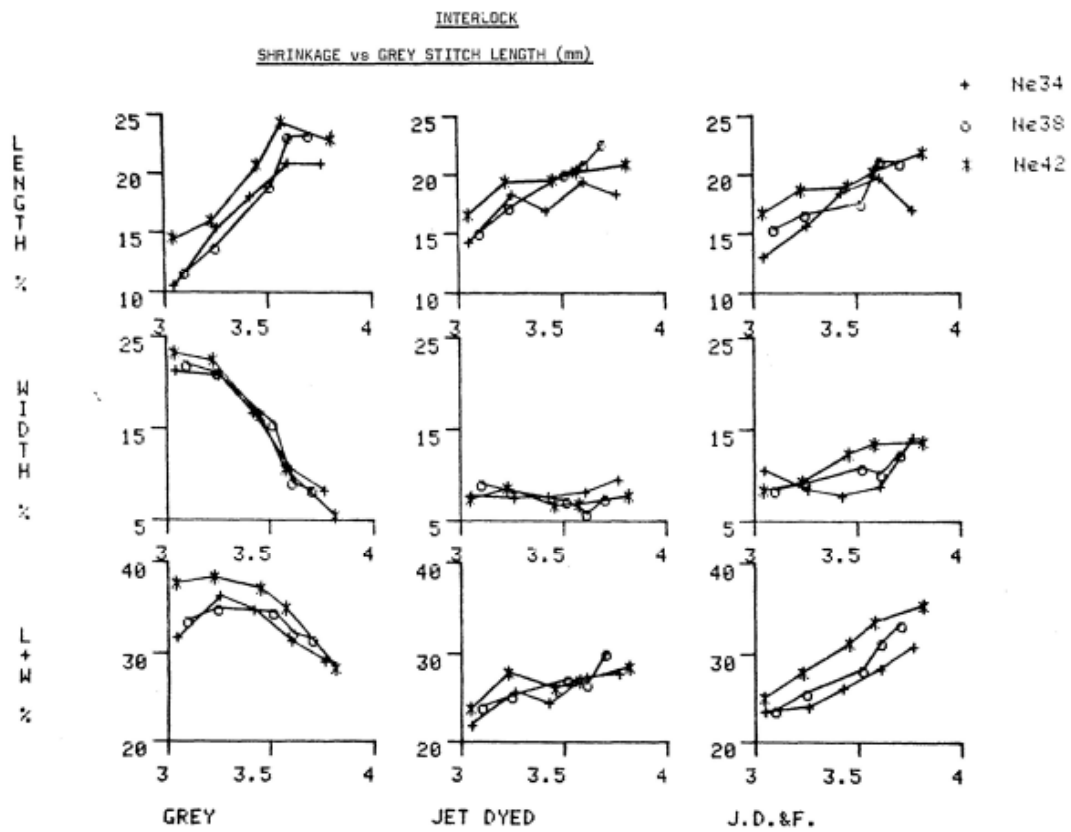


Figure 2

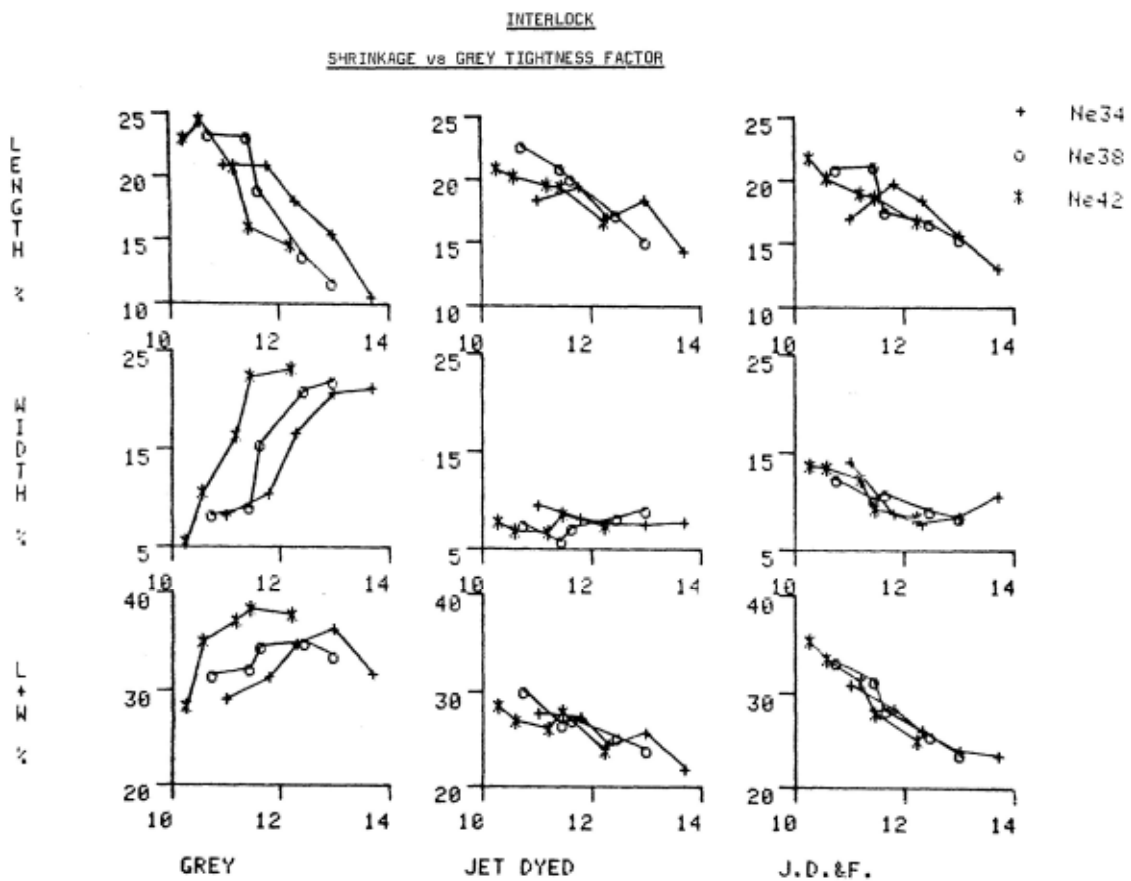


Figure 3

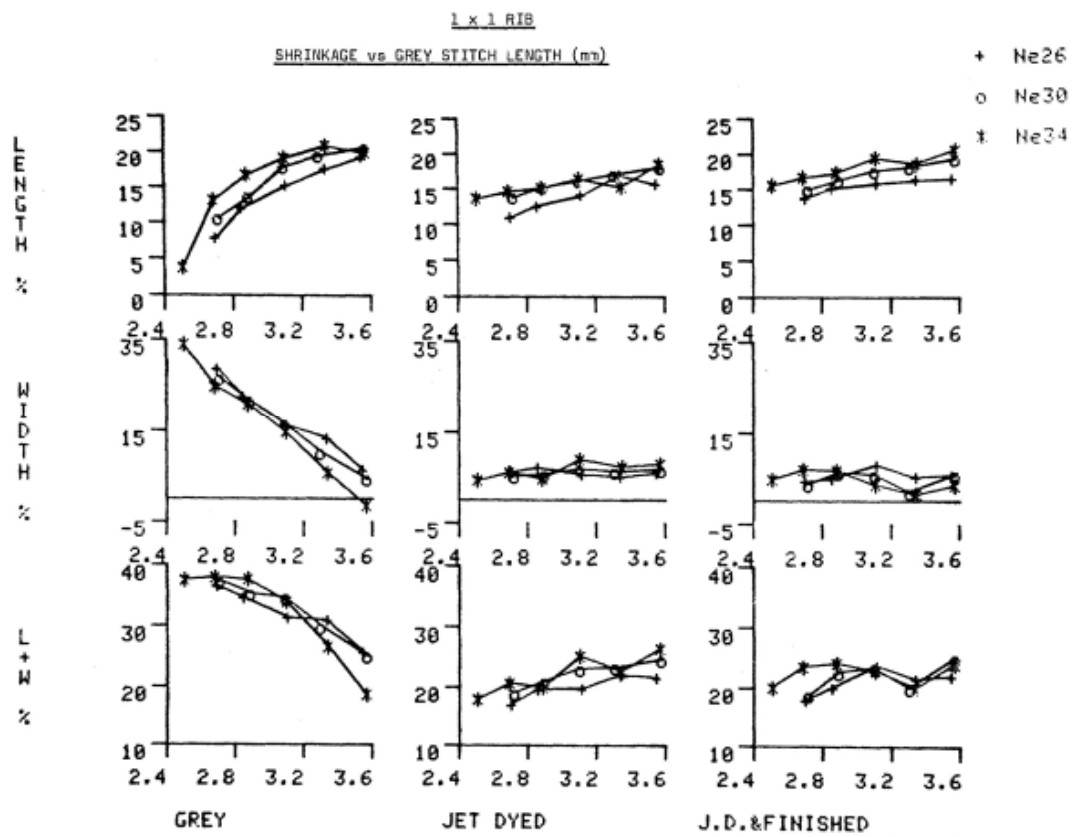


Figure 4

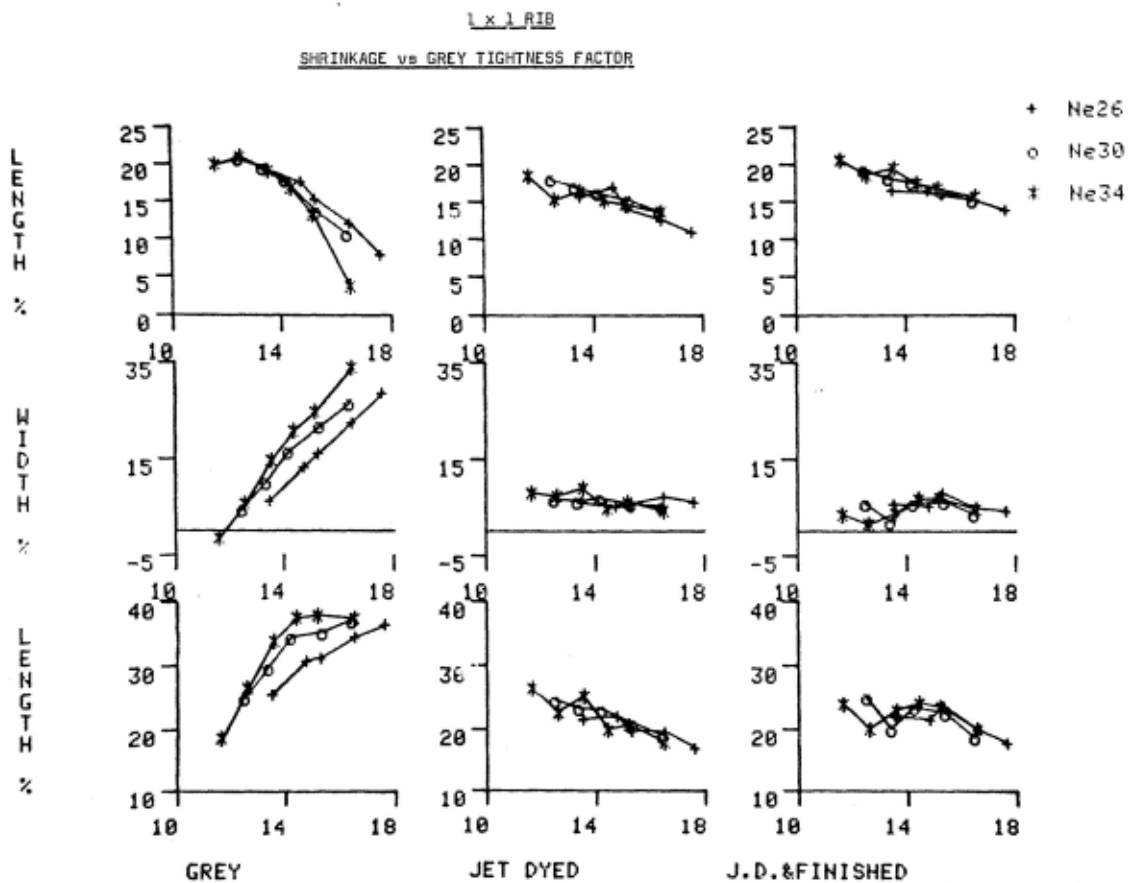


Figure 5

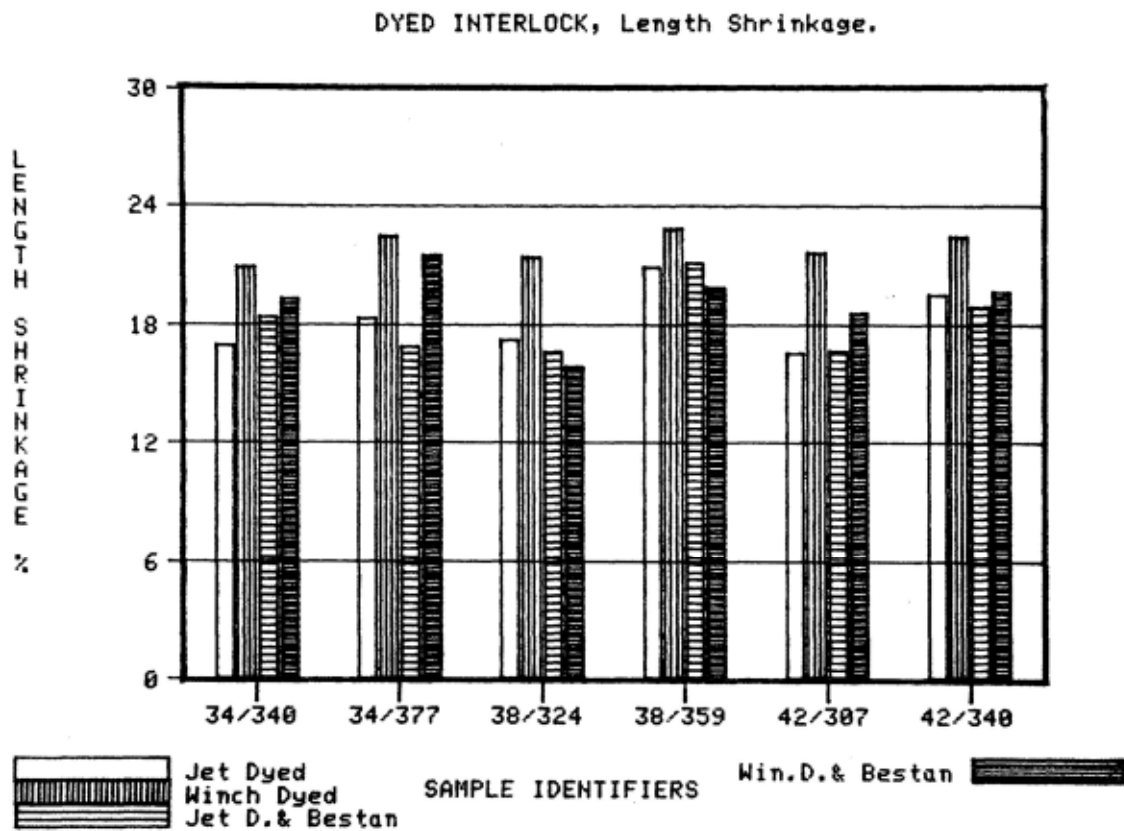


Figure 6

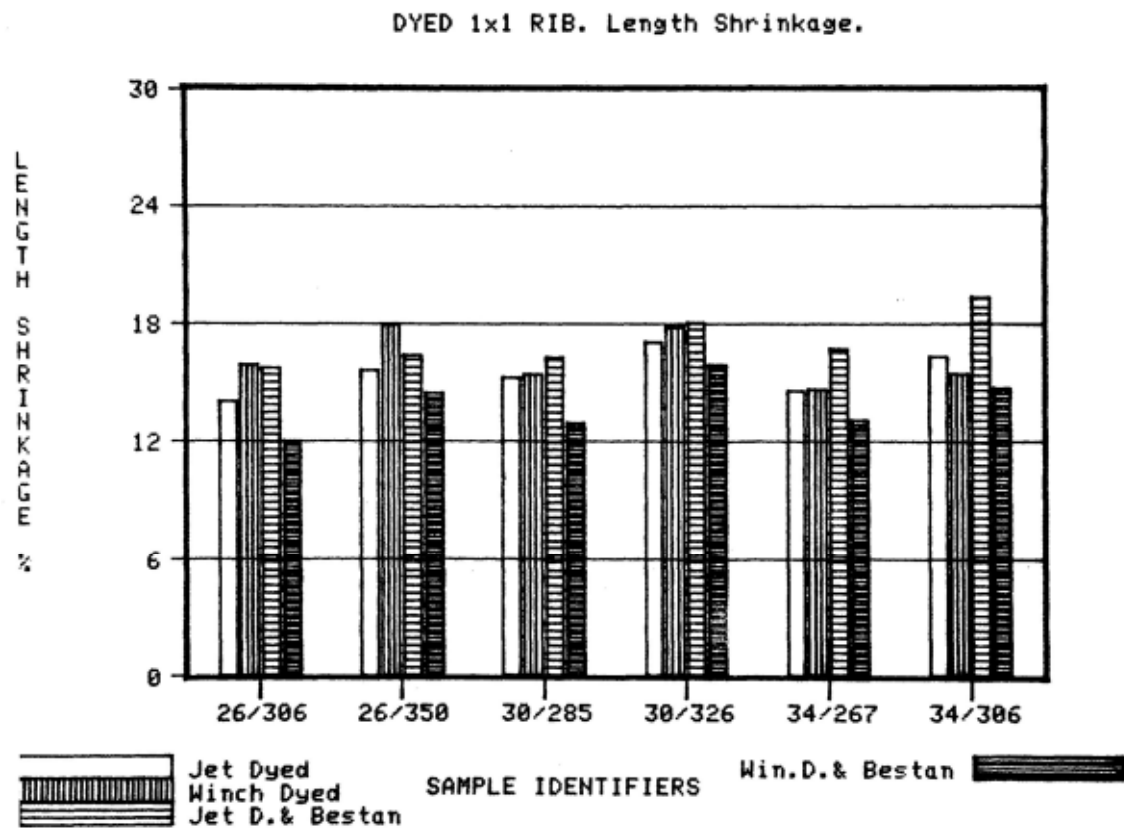


Figure 7

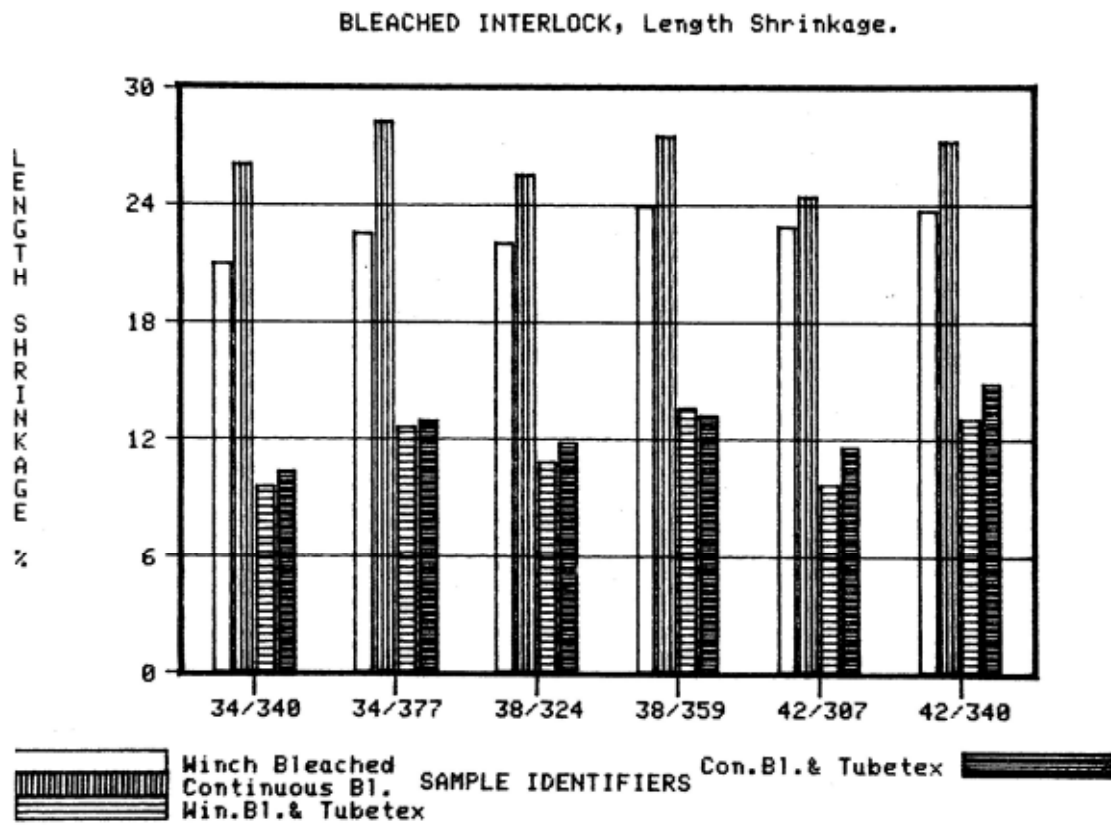


Figure 8

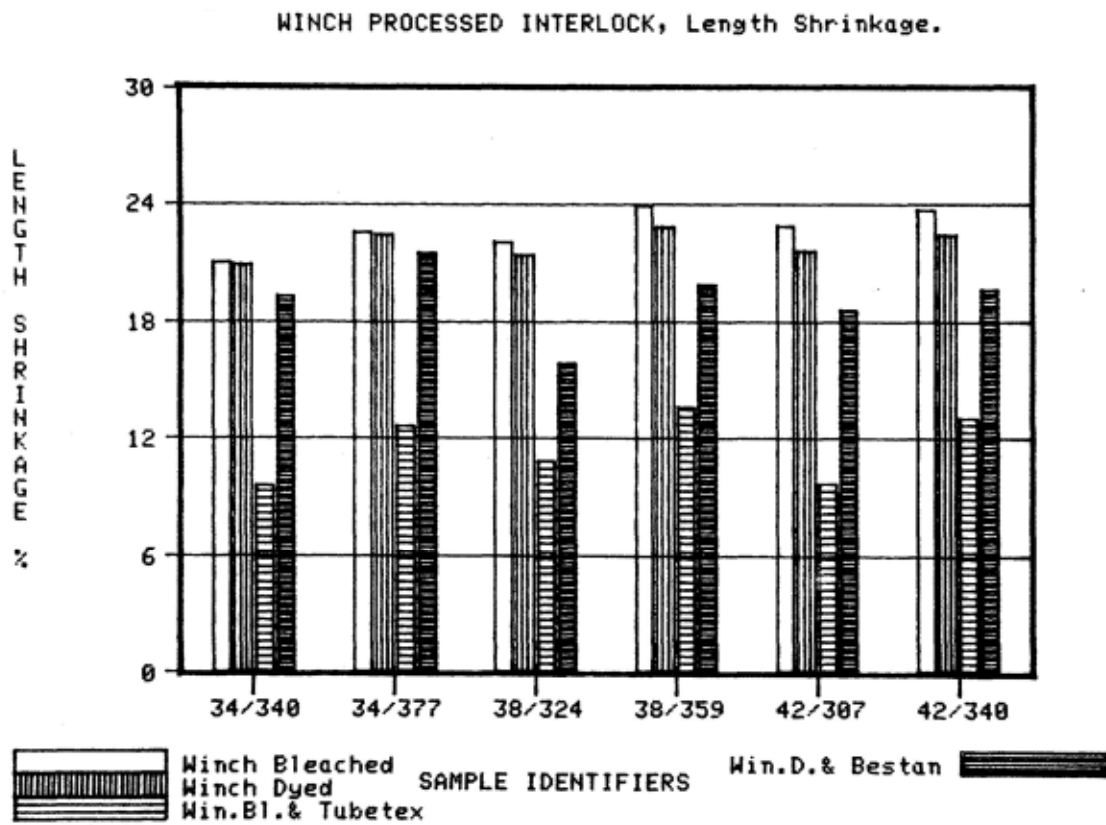
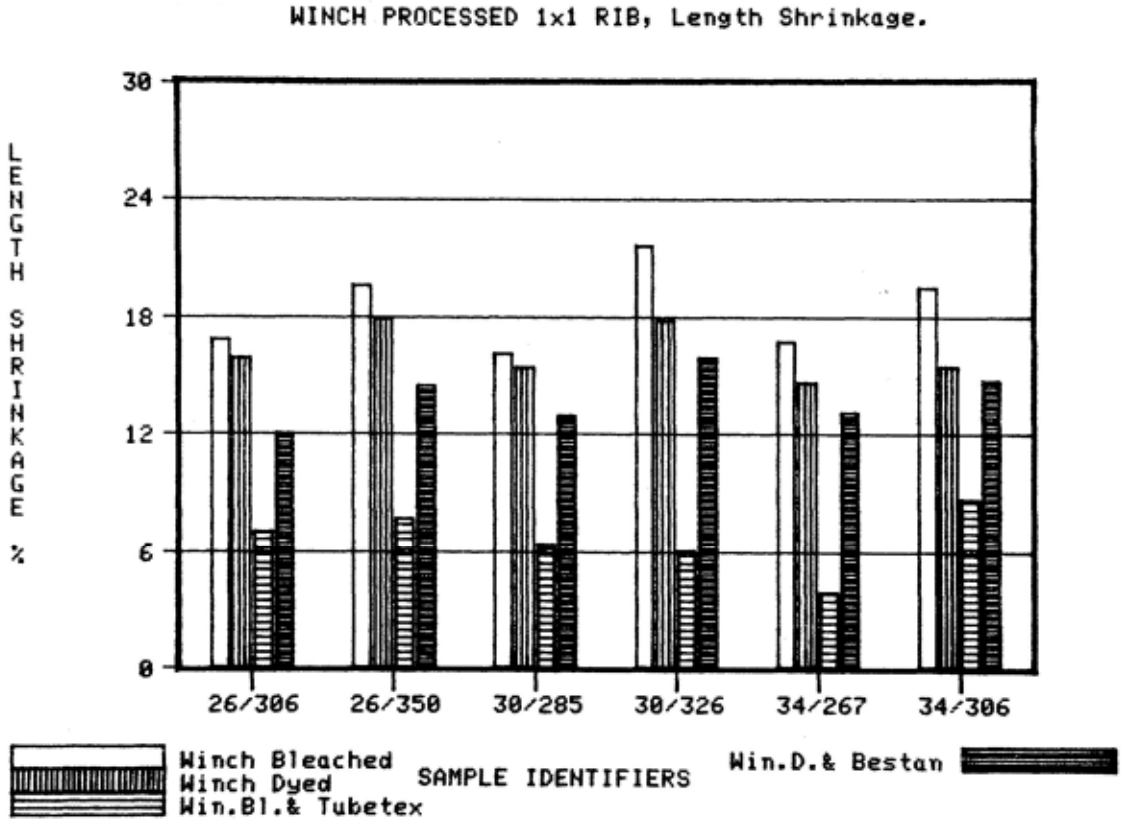


Figure 9



Appendix

D.T.I. and MERIDIAN INTERLOCK SHRINKAGE DATA.
 (+---D.T.I., o---Meridian Ne34, *---Meridian Ne38)

D.T.I., Ne30		
S.L.	SHR-L	SHR-W
3.30	13.10	3.00
3.54	15.20	-2.30
3.86	19.30	-5.70
4.22	22.50	-16.30

MERIDIAN, Ne34		
S.L.	SHR-L	SHR-W
3.15	11.40	23.00
3.40	16.70	19.80
3.65	19.00	15.90

MERIDIAN, Ne38		
S.L.	SHR-L	SHR-W
3.15	15.30	22.40
3.40	19.80	18.00
3.65	20.30	17.80

