

SHRINKAGE 85

Part 6

SUMMARY OF RESULTS

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## 1. INTRODUCTION

The measurement of shrinkage in knitted cotton fabrics has been the subject of many investigations and research projects, both by IIC and others. In particular, IIC's work on cotton knitgoods and the development of the STARFISH model rests on the definition and reliable reproduction of a Reference State of Relaxation on which to make measurements.

Effective utilisation of the STARFISH model therefore depends on the ability of other laboratories to reproduce this Reference State. The Reference State of Relaxation has been defined in terms of a relaxation procedure which consists of one cycle of washing and tumble drying, followed by four cycles of rinsing and tumble drying.

Previous work has indicated that the conditions of washing (e.g. cycle time, temperature etc.,) are not critical to the determination of shrinkage when tumble drying follows the washing/rinsing cycle, although this is not necessarily the case if drying is carried out on a line, for example, or if a fabric softener such as 'Comfort' is included during the final rinse of each washing/rinsing cycle.

However, although reproducibility is very good when measuring shrinkage to the Reference State in our own laboratory (measured values are calculated to be within one shrinkage unit of the true values 95% of the time), results obtained in comparison trials with other laboratories are sometimes less satisfactory. One possible reason for the lack of reproducibility between laboratories is that there are differences in the conditions of tumble drying which are allowing variation in the amount of residual moisture remaining in the fabrics under test at the end of the tumble drying cycle.

IIC's test procedure for obtaining the Reference State of Relaxation specifies that the standard load should be dried to constant weight after each washing/rinsing cycle. Some laboratories, however, consider that drying to the original conditioned weight of the load (normal regain) should be sufficient. There is, however, evidence to show that cotton knitgoods continue to shrink if tumble drying is continued below normal regain. For example, when very low levels of residual moisture (less than 2%) are achieved the additional shrinkage which is developed can be significantly higher than at 6-7% moisture. Lack of consistency in final moisture content is therefore a potential source of variation between laboratories.

To investigate the relationship between moisture content and shrinkage in tumble drying more thoroughly, a preliminary investigation was carried out. This was designed to monitor the development of shrinkage and the rate of reduction of moisture content in a cotton knitted fabric by making measurements at regular time intervals during a standard 5-cycle relaxation sequence. In the light of the results obtained from this preliminary investigation, which was carried out using a winch dyed and finished interlock fabric, a further series of trials was devised.

In these subsequent trials, shrinkage, fabric weight and moisture content were monitored on sets of samples, prepared from four different fabric qualities. The samples were washed/wet-out according to standard procedures, but in each trial the samples were tumble dried for different lengths of time. In addition, each tumble drying cycle included a 10-minute cool down period. Measurements were taken at the end of each completed tumble dry cycle and again after reconditioning in the laboratory. In each trial an additional set of samples was also prepared from the same fabric piece and washed under identical conditions. This set was line dried in a conditioned atmosphere for 24 hours for comparison.

The detailed results from both the preliminary investigation and the subsequent four trials carried out during 1985 and 1986 have been reported in Research Records No. 208, 210, 217, 220 and 229. This report is intended to summarise these results and thus complete this particular investigation into the influence of tumble drying on the measurement of shrinkage in circular weft knitted cotton fabrics.

## 2. SAMPLE SELECTION AND PREPARATION

### 2.1 Sample Selection

The fabric samples used in these investigations had all been knitted and finished under commercial conditions during previous trials. The qualities selected were:-

Trial 1. Preliminary investigation.  
20g Interlock; Ne 1/38; SL 0.338 cm; winch dyed.

Trial 2.  
20g Interlock; Ne 1/38; SL 0.338 cm; winch dyed.

Trial 3.  
28g Single Jersey; Ne 2/72; SL 0.287 cm; Dornier tubular mercerised, Gyrostock dyed.

Trial 4.  
14g 1 x 1 Rib; Ne 1/30; SL 0.282 cm; winch bleached.

Trial 5.  
28g Single Jersey; Ne 2/72; SL 0.287 cm; Gyrostock dyed.

### 2.2 Sample Preparation

#### 2.2.1 Tumble dry sets

For each trial identical sets, each comprising 5 standard shrinkage specimens (50 x 50 cm<sup>2</sup> template), were prepared from one piece of the appropriate fabric quality. The number of sets varied, depending upon the

trial. Trial 1, one set; Trials 2 and 4, five sets; Trials 3 and 5, six sets.

Each specimen was conditioned in the laboratory, marked, measured and weighed prior to laundering. Each set of five specimens was then made up to a standard load of 2.75 kg, using make-weight fabric of a similar construction.

Initial moisture contents and % regains were determined from separate samples taken from the same pieces for each of the fabric qualities in each trial.

### 2.2.2 Line dry sets

For trials 2 - 4 an additional set of 5 standard shrinkage specimens was prepared from the same rolls of fabric, and the specimens conditioned, marked and measured. These were then made up to a standard load of 2.75 kg, using make-weight fabric of a similar construction.

## 3. EXPERIMENTAL PROCEDURE

### 3.1 Tumble Dry Sets

#### 3.1.1 Trial 1

The five shrinkage specimens were washed, together with the make-weights, in a Hoover automatic domestic washing machine at 60°C.

After completion of the washing cycle the load was transferred to a Hoover, continuous action, domestic tumble dryer and tumble dried at the hottest temperature setting for 30 mins.

At the end of 30 mins the load was removed from the tumble dryer, the shrinkage specimens weighed and measured, and then the whole load returned to the tumble dryer.

Measuring and weighing of the shrinkage specimens was repeated at 10-minute intervals until the average weight of the specimens remained constant. This was achieved at 80 mins, i.e. the average weight of the shrinkage specimens remained constant between 70 and 80 mins. The drying time for the load was therefore established at 70 mins, and consequently tumble drying after all subsequent cycles was stopped at 70 mins.

The load was then returned to the washing machine and re-wet-out using the rinse cycle. On completion of the rinse cycle the load was transferred to the tumble dryer and dried on the hottest temperature setting for 30 mins. The load was then removed, the test specimens weighed and measured, and the whole load returned to the tumble dryer. Measurements were taken, as for

the first cycle, at 10-minute intervals until 70 mins, the drying time for the load established from the first cycle.

The rinse/tumble drying cycles were repeated a further 3 times, with measurements and weights being recorded every 10 mins from 30 to 70 mins during tumble drying.

All measurements were made on the specimens taken straight from the tumble dryer without conditioning.

During the time it took to measure and weigh the shrinkage specimens the tumble dryer was left running at the hottest temperature setting to maintain the temperature in the drum.

### 3.1.2 Trials 2-5

Each set of shrinkage specimens, plus make-weights, was washed in a Hoover automatic domestic washing machine at 60°C.

On completion of the washing cycle the test specimens were weighed and then the full load transferred to a Hoover, continuous action, domestic tumble dryer and tumble dried on the hottest temperature setting for a specified length of time. Tumbling was then continued for a further 10 mins with the heat turned off by using the cool-down setting on the tumble dryer:-

- Set 0      30 mins HOT tumble + 10 mins COOL down.  
            Total time in tumble dryer = 40 mins.
- Set 1      40 mins HOT tumble + 10 mins COOL down.  
            Total time in tumble dryer = 50 mins.
- Set 2      50 mins HOT tumble + 10 mins COOL down.  
            Total time in tumble dryer = 60 mins.
- Set 3      60 mins HOT tumble + 10 mins COOL down.  
            Total time in tumble dryer = 70 mins.
- Set 5      80 mins HOT tumble + 10 mins COOL down.  
            Total time in tumble dryer = 90 mins.
- Set 7      100 mins HOT tumble + 10 mins COOL down.  
            Total time in tumble dryer = 110 mins.

On completion of the specified drying time, the test specimens were weighed, measured and then transferred to the laboratory for reconditioning in the standard atmosphere (65% R.H., 20°C). Each specimen was allowed to recondition overnight (minimum 12 hours).

After reconditioning, the specimens were reweighed, remeasured and then the complete load was re-wet-out in the washing machine using the rinse cycle.

On completion of the rinse cycle the test specimens were weighed and the load transferred to the tumble dryer and dried for the appropriate length of time, i.e. Set 0, 30 + 10 mins, Set 1, 40 + 10 mins, etc.

On completion of the specified drying time, the test specimens were weighed, measured and then transferred to the laboratory for reconditioning, reweighing and remeasuring.

The rinse/tumble drying cycles were repeated a further 3 times for each set. Measurements were taken, both straight from the tumble dryer and after reconditioning in the laboratory.

In trials 2 and 4, five sets, nos. 1, 2, 3, 5 and 7, were measured. In trials 3 and 5 an additional sixth set, no. 0, which had a reduced drying time, was included to ensure that the specimens would leave the tumble dryer with high moisture contents.

### 3.2 Line Dry Sets

In trials 2 - 5 a line dry set was included for comparison. This was washed in a Hoover automatic domestic washing machine at 60°C in the same way as the tumble dry sets.

On completion of the washing cycle the test specimens were weighed and then hung on a line in the laboratory in the standard conditioned atmosphere and left to dry for 24 hours. After 24 hours the test specimens were weighed and measured before being returned, with the make-weights, to the washing machine for rewetting using the rinse cycle.

On completion of the rinse cycle the specimens were reweighed and hung on a line in the conditioned laboratory for 24 hours before measuring and reweighing.

The rinse/line dry cycle was repeated a further three times.

In trial 2, after the fifth rinse/line dry cycle had been completed, the specimens were left for a further 24 hours and then reweighed and remeasured. At the end of this period each specimen was oven dried and reweighed.

## 4. RESULTS

The results obtained from each trial are summarised in Appendices 1 to 5 respectively at the end of this report.

For the preliminary trial, Trial 1, shrinkage results obtained through each cycle of the standard five-cycle relaxation procedure are plotted against the (%) moisture content obtained by calculation from the measured weight of

the samples. Standard deviations for length and width shrinkage are similarly illustrated.

For trials 2 - 5 shrinkage results obtained at the end of each full cycle for all sets, both before and after conditioning, are plotted against fabric moisture content. Moisture content (%) was calculated from the weight of each specimen measured immediately after leaving the tumble dryer at the end of the specified drying time and before reconditioning. Standard deviations for length and width shrinkage are similarly illustrated. The results are identified both by set, and by cycle, on the same page for comparison.

Also illustrated are the average shrinkage results obtained from each set and the average standard deviations both before and after conditioning.

The average (%) moisture content in the reconditioned samples for each set is also shown compared to the average (%) moisture content in the samples on leaving the tumble dryer and the original (%) moisture content of the samples at the beginning of the trials.

## 5. SUMMARY

The results obtained from the preliminary trial confirmed that:-

- (1) Shrinkage increases progressively as the residual moisture content in the samples reduces.
- (2) Maximum shrinkage is only developed at very low residual contents <2%.
- (3) For length shrinkage in particular, shrinkage is progressive with number of cycles.
- (4) Width shrinkage is more variable than length shrinkage, and on average the lowest levels of variation are obtained at minimum residual moisture contents <2%.

The results obtained from trials 2 - 5 showed that:-

- (1) On average, shrinkage increases progressively as the residual moisture content in the samples reduces.
- (2) Maximum shrinkage is only developed at very low residual moisture contents <2%.
- (3) The effect of conditioning upon measured shrinkage values depends on the fabric moisture content after tumbling. If the moisture content in the fabric is greater than about 10%, then there is an increase in shrinkage after conditioning. If the fabric moisture content is less than about 10%, then the shrinkage is lower after conditioning.



- (4) Variation in shrinkage is generally higher at high moisture contents and lower at low moisture contents, although in all cases conditioning improves the variability.
- (5) Variation is generally greater for width shrinkage than length shrinkage.
- (6) Sets which were not tumble dried below their original moisture content (normal regain) retained higher residual moisture contents after conditioning. Those which had been dried below their original moisture content tended to have lower moisture contents after conditioning.
- (7) Tumbling for extended periods of time, after minimum residual moisture contents have been achieved, on average does not adversely affect the shrinkage results obtained.
- (8) Shrinkage in length generally increases with the number of cycles, but on average maximum width shrinkage is achieved after the first cycle, provided that tumbling times are sufficient to ensure that minimum residual moisture contents are achieved. The difference in length shrinkage between the first and fifth cycle depends on the fabric structure.
- (9) Line drying develops less shrinkage than tumble drying, although the size of the difference depends on the fabric structure.
- (10) Length shrinkage shows a tendency to increase in line drying with the number of cycles. Width shrinkage shows little change with the exception of the 1 x 1 Rib fabric which tended to grow in width in line drying.
- (11) Line drying is, on average, more variable than tumble drying, especially in the width direction.

## 6. CONCLUSIONS

The results obtained from this series of trials have shown that the conditions of tumble drying, and in particular the amount of moisture remaining in the samples when tumble drying is curtailed, will affect both the absolute values obtained and the variability of the results.

In order to develop the maximum shrinkage potential in a fabric, and contain variation in the results to a minimum, tumble drying should be continued until the residual moisture content in the samples is no greater than 2%.

Reconditioning after tumble drying will improve both the absolute values obtained and the variability in the results.

Dissimilarities in the conditions of tumble drying which affect residual fabric moisture content are therefore a potential source of variation and disagreement in shrinkage results obtained by different laboratories.

#### 7. SHRINKAGE GUIDELINES FOR USE WITH THE STARFISH MODEL

The results obtained from the series of trials described above have provided information about the relationship between moisture content and the development of shrinkage in tumble drying. They have also provided information about line drying and the influence of a number of cycles on the development of shrinkage in different fabrics. From these results, therefore, it is possible to derive some provisional guidelines for use with the STARFISH model which relate the results which would be obtained from test methods which use fewer cycles, or line drying instead of tumble drying, to those which would be obtained using the Reference Relaxation Procedure.

For trials 2 - 5 the mean results obtained from Sets 3, 5 and 7 are very similar. These have therefore been averaged in order to obtain a comparison between the behaviour of each fabric construction in tumble drying and line drying, and to illustrate the influence of number of cycles. The results are summarised in Tables 1 - 2.

For each fabric type length shrinkage is greater after five cycles than after one in both tumble and line drying. In tumble drying the largest difference is found for the interlock fabric, almost 4%, the least for the dyed only plain jersey, 1.2%. In line drying the average increase is around 1%, slightly more for interlock, slightly less for rib and jersey.

For width shrinkage there is little or no difference between cycles in the tumble dried samples. With line drying, however, there is a consistent reduction in shrinkage which is only marginal for interlock and plain jersey, but which amounts to 2% percentage points for the 1 x 1 rib fabric.

All fabrics shrink less in line drying than tumble drying, but the size of the differences varies between different fabric structures.

For plain jersey length and width behave similarly. Shrinkage is less in line drying by about 4.9% for mercerised jersey and by about 3.8% for the dyed only fabric. For interlock length shrinkage is less in line drying by 4.3%, width by 5.2%, and for 1 x 1 rib length is less by 2.2% and width by 7.6%.

Thus, although the choice of five cycles, including tumble drying, is justified for the Reference Relaxation Procedure in order to ensure that the maximum shrinkage potential in a fabric is discovered, when the STARFISH model is being used to develop specifications for fabrics which have to pass other test methods, e.g. line drying or one-cycle tumble dry tests, then some comparative guidelines are useful. In particular, fabric shrinkage

specifications to tumble drying should not be set so low as to produce extension or growth if the resulting garment is line dried.

From the results of these trials, therefore, the following guidelines can be constructed.

If the test method includes only 1 cycle of tumble drying, average length shrinkage values predicted by STARFISH can be reduced by:-

Interlock	-	4%
1 x 1 Rib	-	2%
Plain Jersey	-	1%.

Width shrinkage after one cycle will be similar to that predicted for all fabric types.

If line drying may be used by potential customers, then in order to avoid the possibility of extension or growth, tumble dry shrinkage specifications developed using STARFISH should not be set at values lower than:-

	<u>Length</u>	<u>Width</u>
Interlock	5%	6%
1 x 1 Rib	3%	8%
Plain Jersey mercerised	5%	5%
Plain Jersey unmercerised	4%	4%.

## SHRINKAGE IN TUMBLE DRYING

TRIALS 2-5 : After Conditioning

Shrinkage Cycle No	% Length		Diff (5-1)	% Width		Diff (5-1)
	1	5		1	5	

Trial 2 Interlock Winch Dye

Tumble	15.6	19.5	3.9	11.7	11.6	-0.1
Line	13	14.2	1.2	7.4	6.5	-0.9
(T-L)	2.6	5.3		4.3	5.1	

Trial 3 Single Jersey Mercerised + Gyrostock Dyed

Tumble	3.1	4.4	1.3	18.9	18.8	-0.1
Line	-0.7	-1.5	0.8	14.2	14	-0.2
(T-L)	3.8	5.9		4.7	4.8	

Trial 4 1x1 Rib Winch Bleached

Tumble	5.4	7.1	1.3	6.3	6.4	0.1
Line	3.8	4.7	0.9	-0.1	-2.6	-2.5
(T-L)	1.6	2.4		6.4	9	

Trial 5 Single Jersey Gyrostock Dyed

Tumble	7.1	8.2	1.1	8.6	9.3	0.7
Line	3.6	4.4	0.8	5.6	5.1	-0.5
(T-L)	3.5	3.8		3	4.2	

=====  
 NB Tumble dry shrinkage values are average of sets 3,5 and 7.  
 Line dry shrinkage values from set 8.

## SHRINKAGE IN TUMBLE DRYING

TRIALS 2-5 : After Conditioning

Average Results : All Cycles

	%LS	SD	%WS	SD
-----				
Trial 2 Interlock Winch Dye				
Tumble	18	0.5	11.7	0.7
Line	13.7	0.9	6.5	1.4
(T-L)	4.3		5.2	
Trial 3 Single Jersey Mercerised + Gyrostock Dyed				
Tumble	3.8	0.6	18.9	0.6
Line	-1.2	0.6	14	1.2
(T-L)	5		4.9	
Trial 4 1x1 Rib Winch Bleached				
Tumble	6.4	0.4	6.3	0.6
Line	4.1	0.5	-1.3	1
(T-L)	2.3		7.6	
Trial 5 Single Jersey Gyrostock Dyed				
Tumble	7.8	0.4	9.1	0.9
Line	4	0.8	5.3	1
(T-L)	3.8		3.8	
=====				

NB Tumble dry shrinkage values are average of sets 3,5 and 7.  
 Line dry shrinkage values from set B.

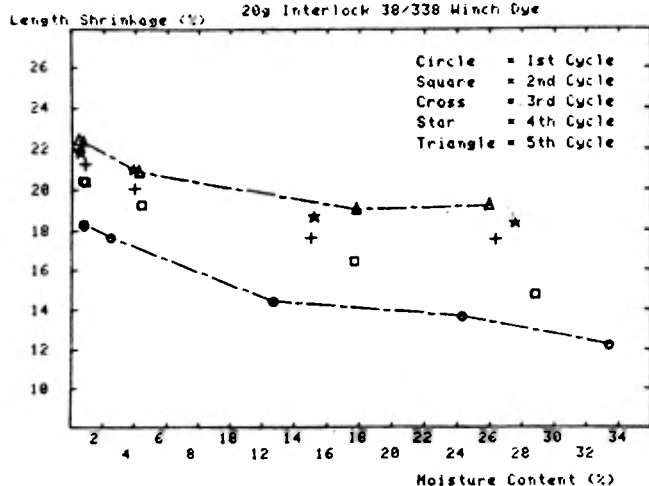
## SHRINKAGE IN TUMBLE DRYING

TRIAL 1 : 20g INTERLOCK, Ne 1/38, SL 0.338cm, WINCH DYE

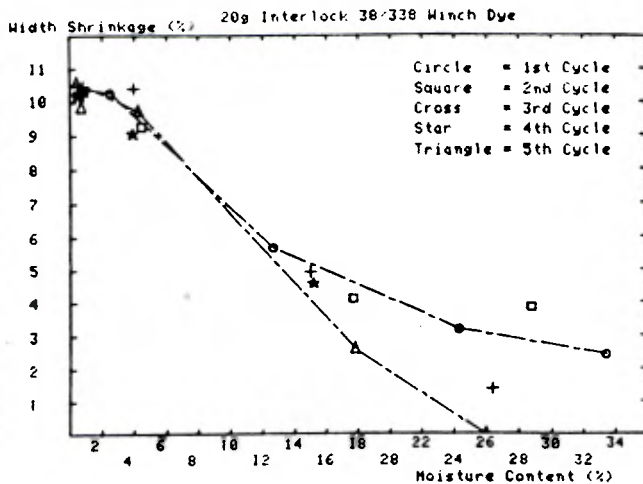
Average of five replications

	Time	%LS	SD	%WS	SD	%MC	SD
1st Cycle	30	12.28	1.5	2.48	0.87	33.44	5.06
	40	13.7	1.11	3.24	0.75	24.29	6.44
	50	14.48	1.31	5.71	3.01	12.65	6.15
	60	17.71	0.57	10.27	1.36	2.49	0.6
	70	18.39	0.5	10.38	1	0.8	0.13
	80	18.31	0.77	10.31	1.18	0.81	0.13
2nd Cycle	30	14.8	0.23	3.9	0.66	28.82	4.11
	40	16.47	0.86	4.17	4.07	17.65	5.2
	50	19.3	0.87	9.26	1.84	4.42	1.83
	60	20.44	0.45	10.38	1.18	0.91	0.18
	70	20.5	0.53	10.38	1.14	0.72	0.2
3rd Cycle	30	17.59	0.93	1.43	1.6	26.37	3.68
	40	17.65	0.59	4.97	1.1	14.95	2.41
	50	20.14	0.58	10.41	0.66	3.95	0.42
	60	21.26	0.6	10.47	1.1	0.8	0.21
	70	21.32	0.63	10.2	1.02	0.81	0.17
4th Cycle	30	18.38	0.7	-0.22	1.86	27.57	4
	40	18.69	0.63	4.62	3.3	15.14	5.39
	50	21.06	0.72	9.06	1.96	3.87	2.29
	60	21.99	0.32	10.16	0.91	0.45	0.4
	70	21.83	0.5	10.26	1.18	0.48	0.09
5th Cycle	30	19.27	0.41	-0.02	3.42	25.96	5.92
	40	19.06	1.21	2.65	3.48	17.76	6.72
	50	20.95	1.05	9.72	1.5	4.22	1.87
	60	22.48	0.58	10.58	0.86	0.4	0.26
	70	22.39	0.5	9.84	1.07	0.68	0.17

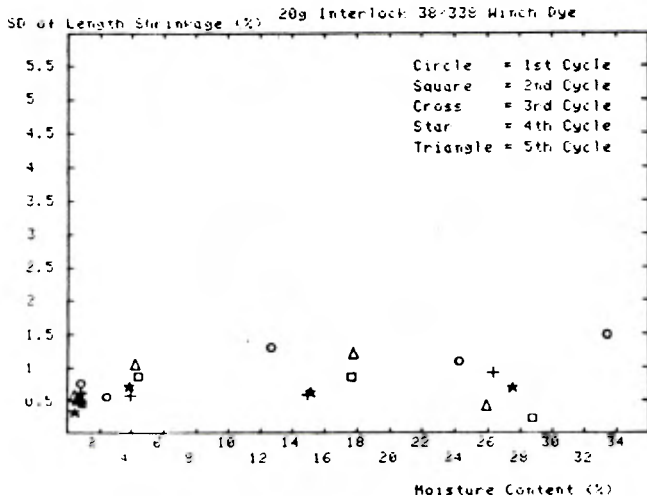
SHRINKAGE IN TUMBLE DRYING : TRIAL 1 (Preliminary)



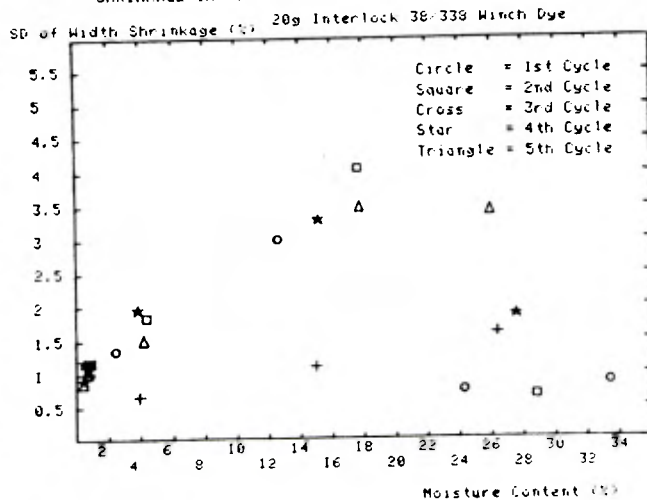
SHRINKAGE IN TUMBLE DRYING : TRIAL 1 (Preliminary)



SHRINKAGE IN TUMBLE DRYING : TRIAL 1 (Preliminary)



SHRINKAGE IN TUMBLE DRYING : TRIAL 1 (Preliminary)



## SHRINKAGE IN TUMBLE DRYING

TRIAL 2 : 20g INTERLOCK, Ne 1/30, SL 0.338cm, WINCH DYE

Average of five replications : Measured immediately

Cycle No	%LS	SD	%WS	SD	%MC	SD
Set 1 Tumble Dry 40+10 mins						
1	10.94	0.93	10.42	1.4	15.95	4.7
2	12.74	0.82	10.04	1.18	12.49	1.75
3	11.7	2.54	11.66	2.24	13.75	2.69
4	13.38	1.24	9.58	1.1	14.15	2.6
5	15.2	0.81	11.58	0.54	9.06	1.26
mean	12.79	1.27	10.66	1.29	13.08	2.6
sd	1.64	0.73	0.93	0.62	2.57	1.32
Set 2 Tumble Dry 50+10 mins						
1	16.18	1.02	11.22	0.54	5.72	0.51
2	18.26	0.42	11.38	0.31	3.48	0.21
3	18.54	0.47	11.74	0.29	4.82	0.66
4	18	0.6	11.42	0.31	6.17	0.5
5	20.3	0.51	11.94	0.6	3.55	0.3
mean	18.26	0.6	11.54	0.41	4.75	0.44
sd	1.47	0.24	0.29	0.15	1.23	0.18
Set 3 Tumble Dry 60+10 mins						
1	17.34	0.56	12.16	0.73	1.78	0.61
2	19.26	0.78	11.6	0.63	1.34	0.09
3	20.22	0.28	11.32	1.02	1.32	0.21
4	20.26	0.36	12.24	0.84	3.09	0.6
5	20.94	0.44	11.96	0.47	1.35	0.08
mean	19.6	0.48	11.86	0.74	1.78	0.32
sd	1.4	0.2	0.39	0.21	0.76	0.27
Set 5 Tumble Dry 80+10 mins						
1	17.2	0.35	12.46	0.4	1.06	0.14
2	19.26	0.37	12	0.45	0.55	0.29
3	20.5	0.4	12	0.42	1.21	0.11
4	21.06	0.5	11.18	1.3	0.22	0.22
5	21.34	0.62	11.7	1.03	0.42	0.19
mean	19.87	0.45	11.87	0.72	0.69	0.19
sd	1.69	0.11	0.47	0.42	0.42	0.07
Set 7 Tumble Dry 100+10 mins						
1	17.18	0.47	11.32	1.16	1.71	0.11
2	18.82	0.25	11.4	0.62	1.58	0.13
3	19.74	0.46	11.4	0.68	1.63	0.14
4	20.5	0.59	11.44	0.73	1.78	0.14
5	20.9	0.37	11.1	0.89	1.43	0.32
mean	19.43	0.43	11.33	0.82	1.63	0.17
sd	1.49	0.13	0.14	0.22	0.13	0.09
Set 8 Line Dry 24hrs Conditioned Atmosphere						
1	12.96	1.09	7.36	1.49	7.32	0.11
2	13.52	0.78	6.52	1.33	7.61	0.1
3	14.18	0.21	6.16	0.7	7.38	0.12
4	13.8	1.72	5.84	1.98	7.42	0.1
5	14.18	0.82	6.54	1.36	7.39	0.11
mean	13.73	0.92	6.48	1.37	7.42	0.11
sd	0.51	0.55	0.57	0.46	0.11	0.01

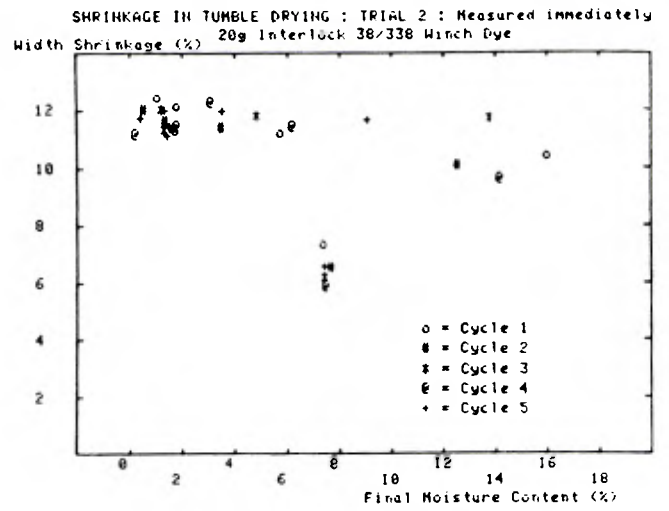
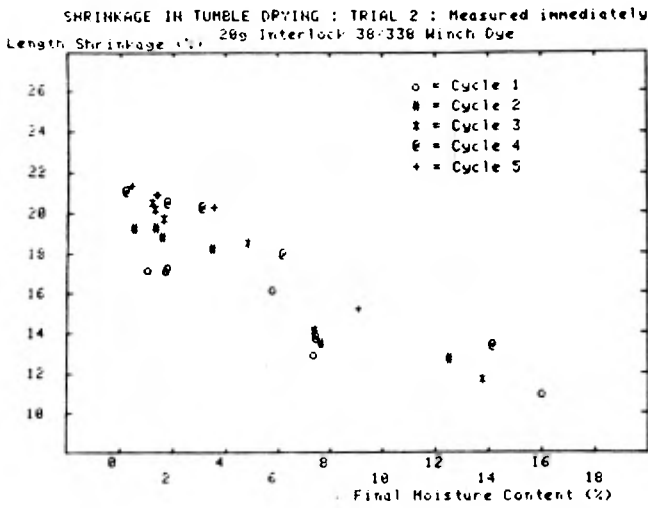
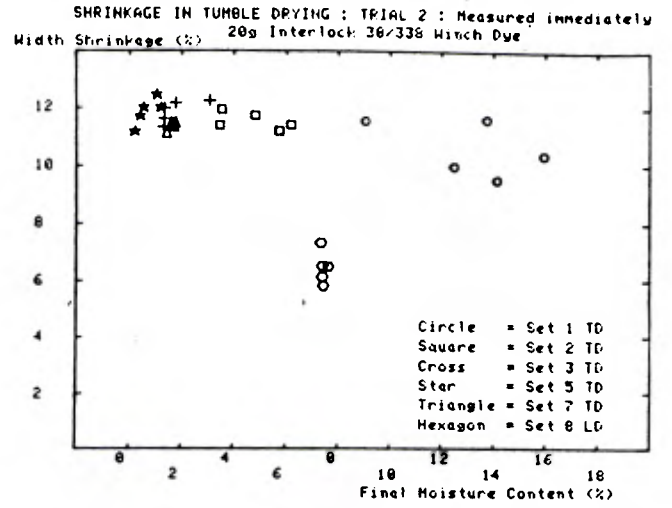
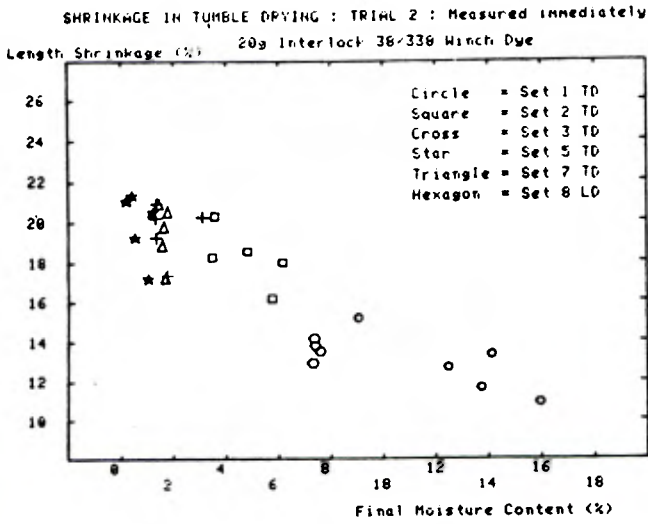


## SHRINKAGE IN TUMBLE DRYING

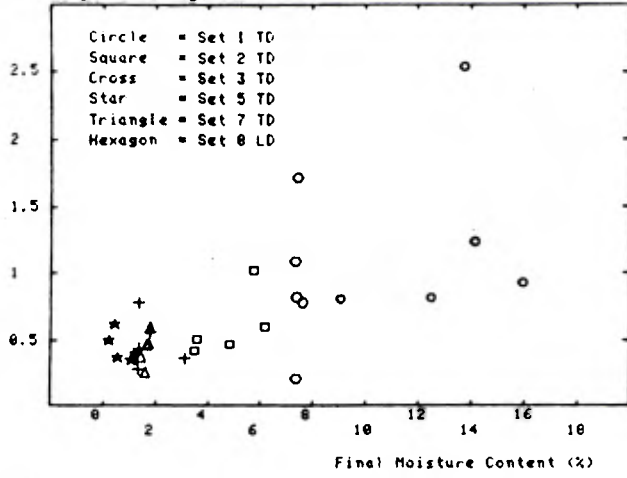
TRIAL 2 : 20g INTERLOCK, Ne 1/38, SL 0.338cm, WINCH DYE

Average of five replications : Measured after conditioning

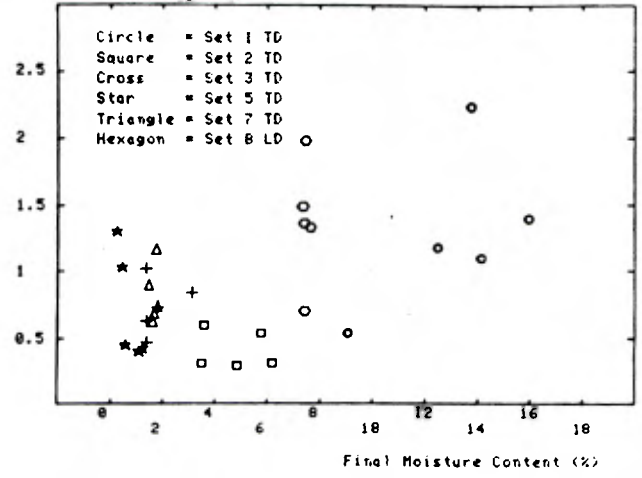
Cycle No	%LS	SD	%WS	SD	%MC	SD
-----						
Set 1 Tumble Dry 40+10 mins						
1	12.46	1.13	9.12	2.32	7.75	0.07
2	13.2	0.62	10.66	0.54	7.56	0.07
3	13.94	0.27	10.1	1.06	7.86	0.14
4	14.44	0.79	9.7	0.73	7.63	0.15
5	15.08	0.36	11.2	0.97	7.64	0.17
mean	13.82	0.63	10.16	1.12	7.69	0.12
sd	1.03	0.35	0.81	0.7	0.12	0.05
Set 2 Tumble Dry 50+10 mins						
1	15.18	0.42	11.02	0.66	7.17	0.2
2	16.94	0.54	11.46	0.27	6.58	0.08
3	16.98	0.68	11.5	0.64	6.71	0.15
4	17.3	0.63	11.58	0.73	7.14	0.17
5	18.34	0.51	11.58	0.43	6.42	0.45
mean	16.95	0.56	11.43	0.55	6.8	0.21
sd	1.14	0.1	0.23	0.19	0.34	0.14
Set 3 Tumble Dry 60+10 mins						
1	15.78	0.36	12.04	0.66	5.99	0.5
2	17.38	0.61	12.04	0.67	6.23	0.03
3	18.66	0.5	11.84	0.29	6.05	0.07
4	18.5	0.5	12.12	0.55	6.4	0.09
5	19.1	0.42	12.32	0.94	6.26	0.08
mean	17.88	0.48	12.07	0.62	6.19	0.15
sd	1.34	0.09	0.17	0.23	0.17	0.19
Set 5 Tumble Dry 80+10 mins						
1	15.52	0.72	11.42	0.69	6.59	0.11
2	17.28	0.68	11.5	0.57	6.15	0.1
3	18.48	0.28	11.42	0.53	6.22	0.19
4	19.48	0.49	11.26	1.02	5.42	1.28
5	19.66	0.62	11.62	0.86	6.13	0.15
mean	18.08	0.56	11.44	0.73	6.1	0.37
sd	1.72	0.18	0.13	0.21	0.42	0.51
Set 7 Tumble Dry 100+10 mins						
1	15.34	0.37	11.6	0.51	6.13	0.08
2	16.98	0.32	11.68	0.52	6.35	0.09
3	18.62	0.39	11.02	1.23	6.3	0.06
4	19.42	0.25	11.96	1.15	5.75	0.07
5	19.58	0.45	10.88	0.67	6.11	0.03
mean	17.99	0.36	11.43	0.82	6.13	0.07
sd	1.8	0.08	0.46	0.35	0.24	0.02
Set 8 Line Dry 24hrs Conditioned Atmosphere						
1	12.96	1.09	7.36	1.49	7.32	0.11
2	13.52	0.78	6.52	1.33	7.61	0.1
3	14.18	0.2	6.16	0.7	7.38	0.12
4	13.8	1.72	5.84	1.98	7.42	0.1
5	14.18	0.82	6.54	1.36	7.39	0.11
mean	13.73	0.92	6.48	1.37	7.42	0.11
sd	0.51	0.55	0.57	0.46	0.11	0.01



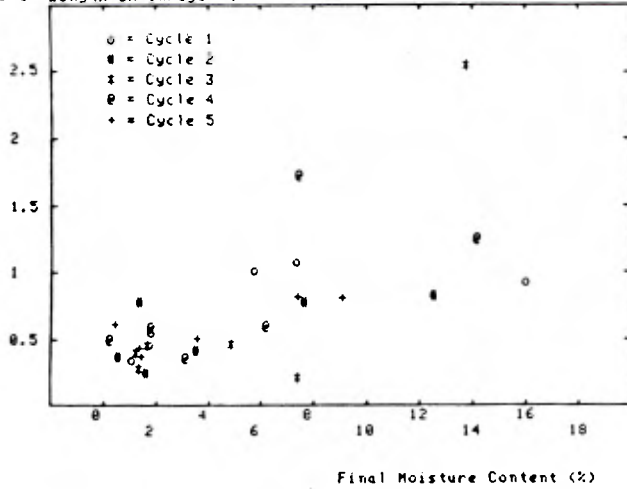
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : Measured immediately  
SD of Length Shrinkage (%) 20g Interlock 38/338 Winch Dye



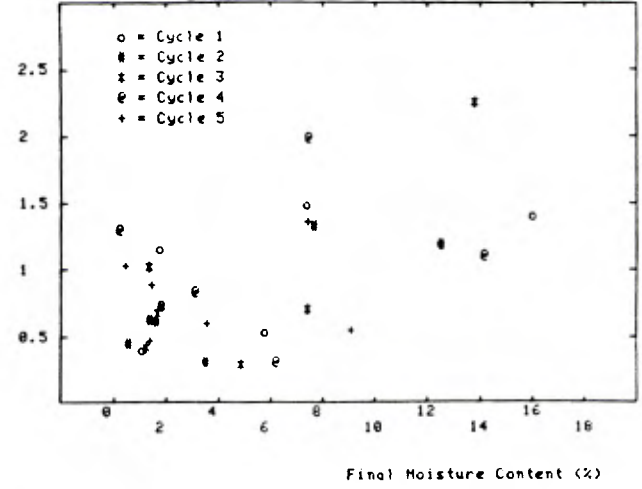
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : Measured immediately  
SD of Width Shrinkage (%) 20g Interlock 38/338 Winch Dye



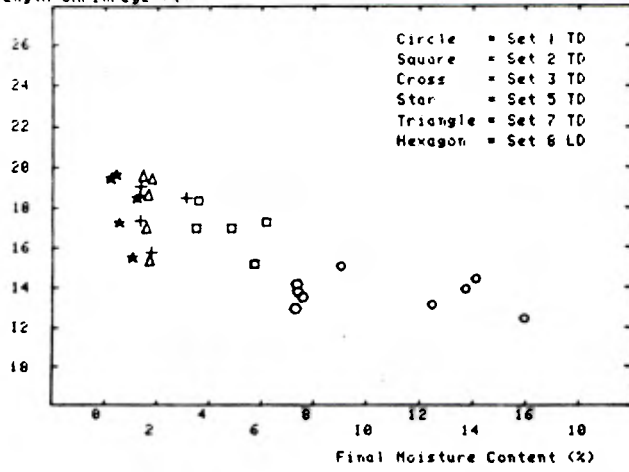
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : Measured immediately  
SD of Length Shrinkage (%) 20g Interlock 38/338 Winch Dye



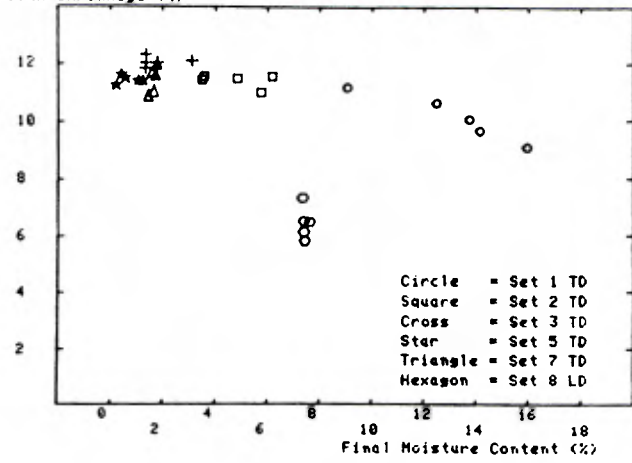
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : Measured immediately  
SD of Width Shrinkage (%) 20g Interlock 38/338 Winch Dye



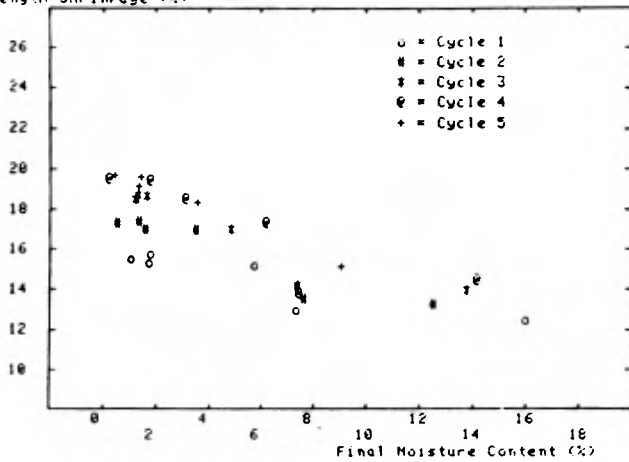
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : After Conditioning  
20g Interlock 38/338 Winch Dye



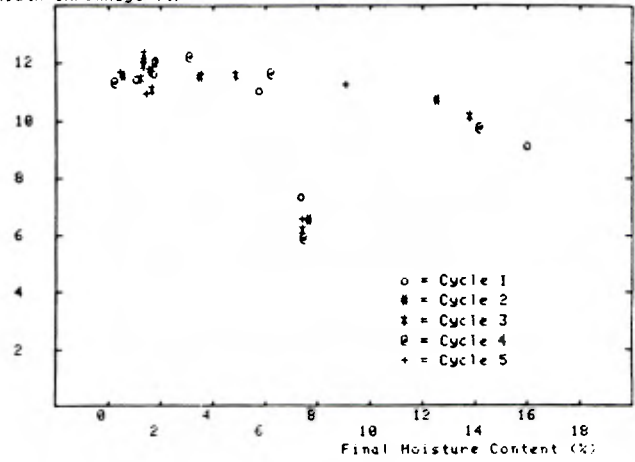
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : After Conditioning  
20g Interlock 38/338 Winch Dye



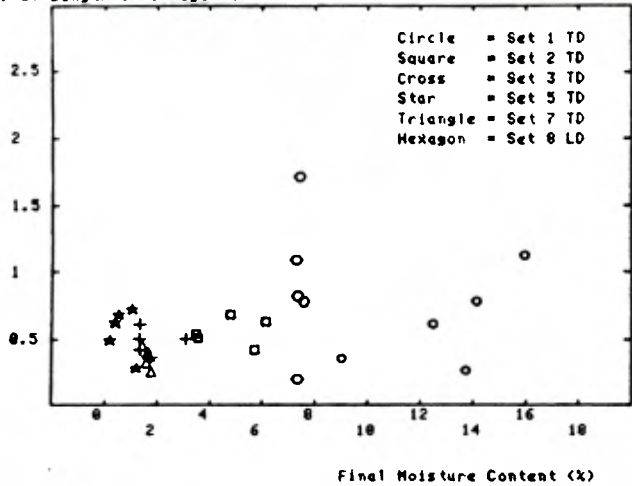
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : After Conditioning  
20g Interlock 38/338 Winch Dye



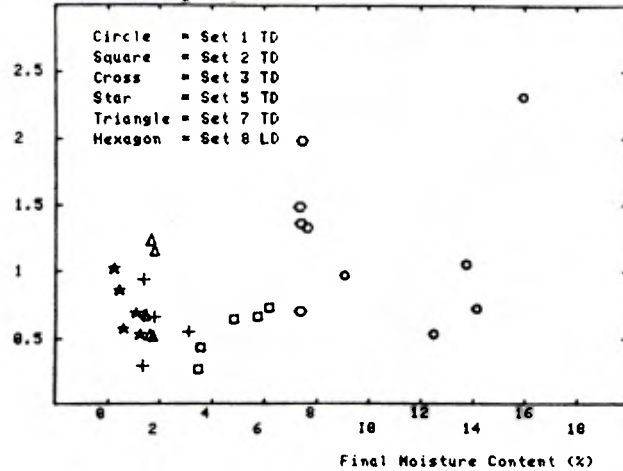
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : After Conditioning  
20g Interlock 38/338 Winch Dye



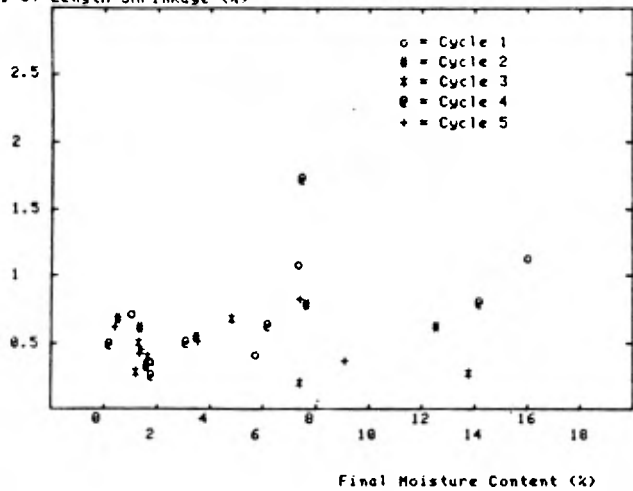
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : After Conditioning  
SD of Length Shrinkage (%) 20g Interlock 38/338 Winch Dye



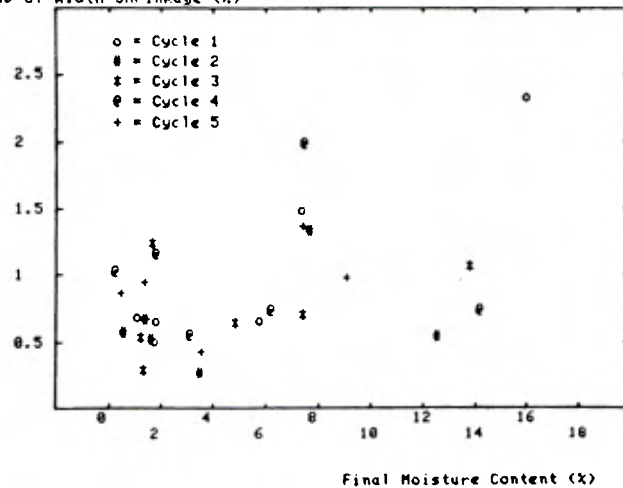
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : After Conditioning  
SD of Width Shrinkage (%) 20g Interlock 38/338 Winch Dye



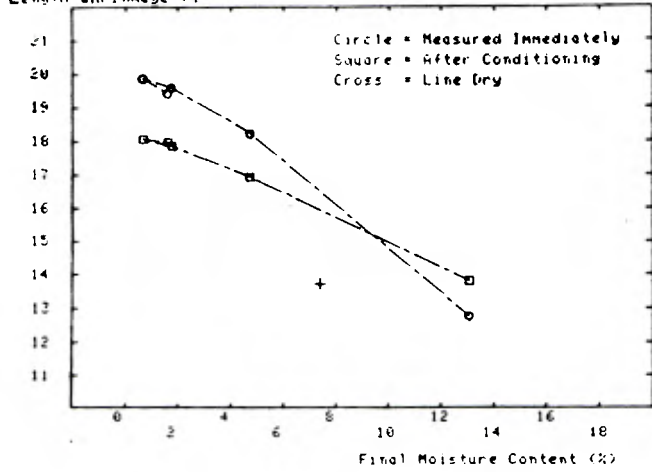
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SD of Length Shrinkage (%) 20g Interlock 38/338 Winch Dye



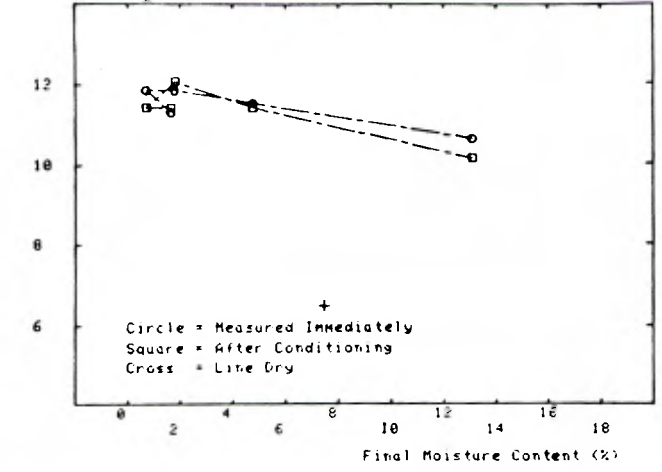
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : After Conditioning  
SD of Width Shrinkage (%) 20g Interlock 38/338 Winch Dye



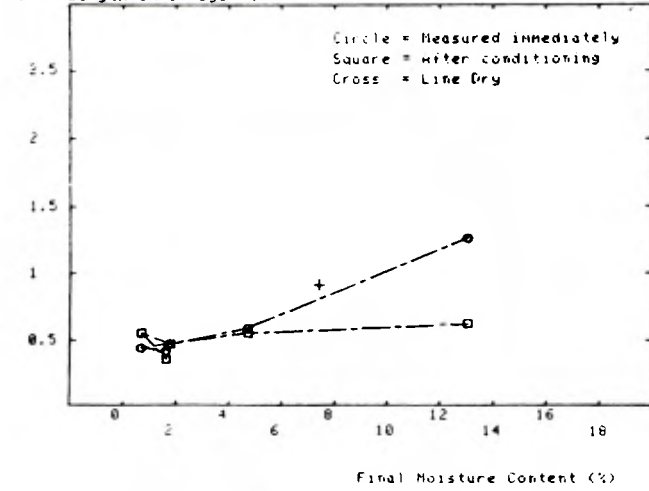
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : Average of 5 Cycles  
 20g Interlock 38/338 Winch Dye



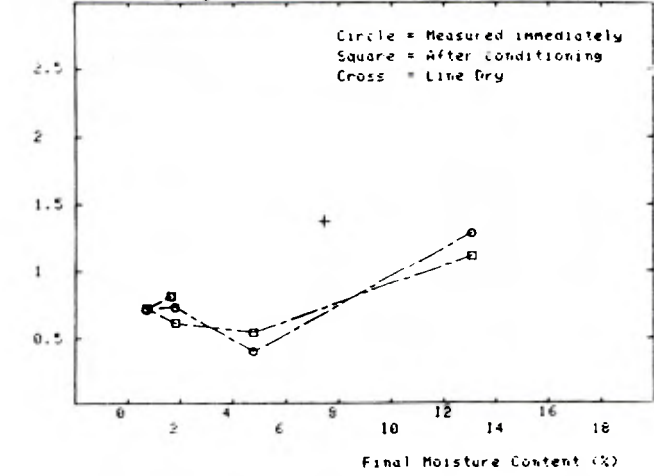
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : Average of 5 Cycles  
 20g Interlock 38/338 Winch Dye



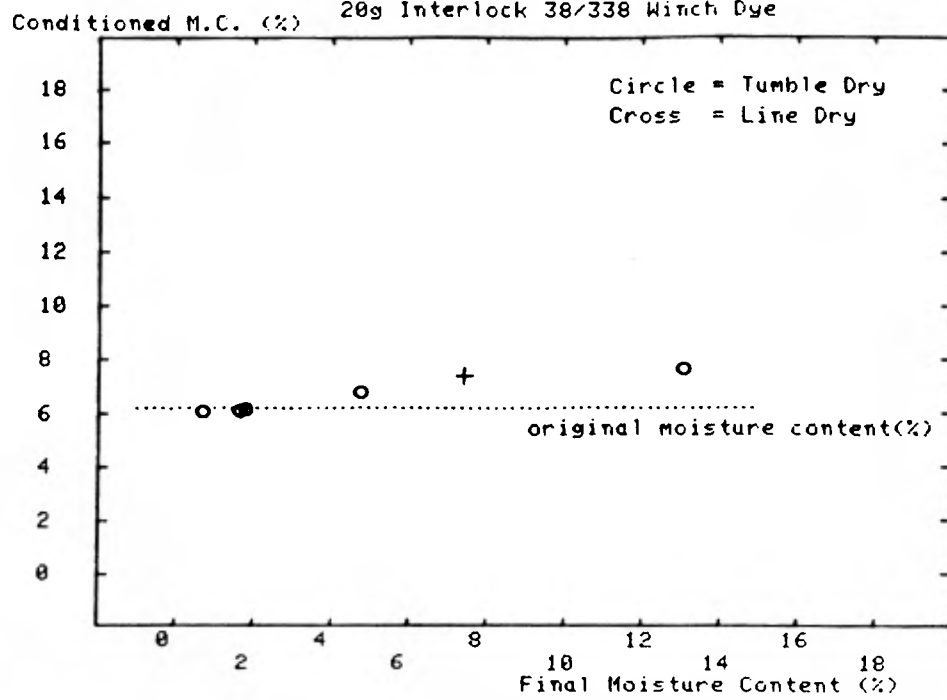
SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : Average of 5 Cycles  
 SD of Length Shrinkage (%) 20g Interlock 38/338 Winch Dye



SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : Average of 5 Cycles  
 SD of Width Shrinkage (%) 20g Interlock 38/338 Winch Dye



SHRINKAGE IN TUMBLE DRYING : TRIAL 2 : Average of 5 Cycles  
20g Interlock 38/338 Winch Dye



## SHRINKAGE IN TUMBLE DRYING

A3/1

TRIAL 3 : 28g SINGLE JERSEY, Ne 2/72, SL 0.287

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Average of five replications : Measured immediately

Cycle No	LS%	SD	WS%	SD	MC%	SD
Set 0 Tumble Dry 30+10 mins						
1	1.12	1.7	11.92	1.56	16.05	3.29
2	0.24	0.8	11.12	1.27	19.3	1.93
3	1.34	0.8	12.62	0.67	16.95	1.19
4	1.58	1.14	13.08	1.28	16.15	2.13
5	0.84	1.13	12.44	1.59	16.37	2.67
mean	1.02	1.11	12.24	1.27	16.96	2.24
sd	0.52	0.37	0.75	0.37	1.35	0.79
Set 1 Tumble Dry 40+10 mins						
1	1.28	1.09	18.72	0.83	13.74	3.13
2	1.52	0.82	19.56	1.06	10.1	2.31
3	2.52	0.41	19.8	1.21	7.78	1.15
4	3.68	0.83	20.54	0.56	5.5	0.81
5	3.16	0.52	21.62	1.17	5.26	1.25
mean	2.43	0.73	20.05	0.97	8.48	1.73
sd	1.03	0.27	1.09	0.27	3.54	0.96
Set 2 Tumble Dry 50+10						
1	3.02	0.83	17.12	0.78	8.3	0.98
2	4.06	0.82	18.56	0.6	2.19	0.22
3	5.02	0.98	18.58	0.79	0.61	0.14
4	5.02	0.98	18.58	0.79	0.42	0.21
5	4.74	0.91	18.4	0.97	3.57	0.93
mean	4.37	0.9	18.25	0.79	3.02	0.5
sd	0.85	0.08	0.64	0.13	3.22	0.42
Set 3 Tumble Dry 60+10 mins						
1	3.8	0.37	20.96	1.29	2.22	0.35
2	5.08	2.25	21.04	0.74	0.62	0.09
3	4.72	0.91	20.92	0.56	0.63	0.12
4	5.48	0.48	21.44	0.94	0.12	0.27
5	5.64	0.41	21.72	0.93	0.04	0.26
mean	4.94	0.88	21.22	0.89	0.73	0.22
sd	0.73	0.79	0.35	0.27	0.88	0.11
Set 5 Tumble Dry 80+10 mins						
1	4.04	0.17	19.62	0.62	0.68	0.15
2	4.2	0.77	19.84	0.71	0.63	0.24
3	4.88	0.61	18.86	0.97	0.49	0.29
4	6.04	0.74	20.1	0.51	-0.43	0.09
5	6.08	0.41	19.78	0.69	0.09	0.25
mean	5.05	0.54	19.64	0.7	0.29	0.2
sd	0.98	0.25	0.47	0.17	0.47	0.08
Set 7 Tumble Dry 100+10 mins						
1	4.4	0.58	21.4	0.63	-0.29	0.18
2	4.52	0.5	20.56	1.01	0.27	0.28
3	4.76	0.89	20.16	0.61	0.77	0.23
4	5.32	0.59	20.32	0.56	0.3	0.17
5	6.48	0.41	19.8	0.95	-0.08	0.27
mean	5.1	0.59	20.45	0.75	0.19	0.23
sd	0.85	0.18	0.6	0.21	0.41	0.05
Set 8 Line Dry 24hrs Conditioned Atmosphere						
1	-0.68	0.67	14.2	1.48	9.14	0.09
2	-1.18	0.3	13.86	1.11	9.37	0.07
3	-1.2	0.62	14.34	1.01	9.06	0.06
4	-1.26	0.59	13.82	1.33	8.78	0.1
5	-1.48	0.62	13.96	1.16	9.3	0.09
mean	-1.16	0.56	14.04	1.22	9.13	0.08
sd	0.29	0.15	0.23	0.19	0.23	0.02



## SHRINKAGE IN TUMBLE DRYING

A3/2

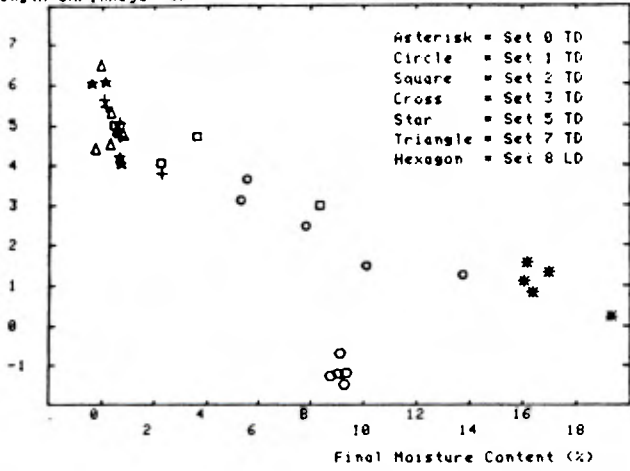
TRIAL 3 : 28g SINGLE JERSEY, Ne 2/72, SL 0.287

DORNIER MERCERISED, GYROSTOCK DYED

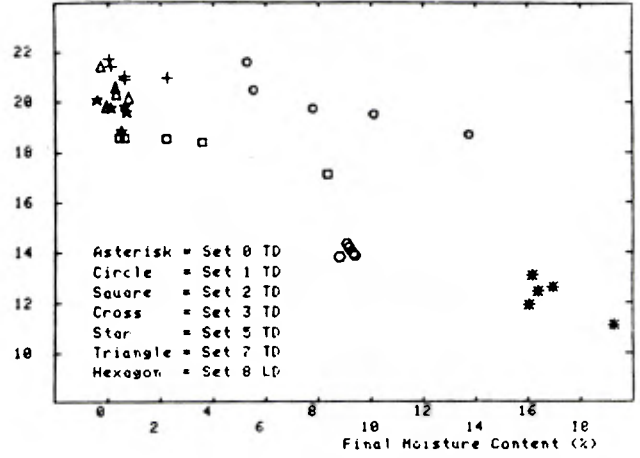
Average of five replications : Measured after conditioning

Cycle No	LS%	SD	WS%	SD	MC%	SD
-----						
Set 0 Tumble Dry 30+10 mins						
1	2.38	1.47	14.1	1.21	9.38	0.1
2	1.12	0.44	13.18	1.21	8.97	0.17
3	1.36	0.59	13.38	0.59	9.21	0.14
4	1.62	1.09	13.6	0.94	8.76	0.16
5	1.36	0.85	13.4	1.36	8.91	0.15
mean	1.57	0.89	13.53	1.06	9.05	0.14
sd	0.49	0.41	0.35	0.3	0.25	0.03
-----						
Set 1 Tumble Dry 40+10 mins						
1	1.56	1.13	18.58	0.64	10.21	0.4
2	1.2	0.51	19.2	0.92	9.62	0.57
3	2.12	0.58	19.24	0.73	9.15	0.37
4	2.56	0.48	19.68	0.71	8.65	0.25
5	2.44	0.88	20.1	0.88	8.73	0.25
mean	1.98	0.72	19.36	0.78	9.27	0.37
sd	0.58	0.28	0.57	0.12	0.65	0.13
-----						
Set 2 Tumble Dry 50+10						
1	2.6	0.99	16.96	0.63	8.6	0.29
2	2.8	0.68	16.82	0.54	7.8	0.06
3	3.42	0.66	17.4	0.81	7.4	0.07
4	3.62	0.92	17.9	1.18	7.48	0.05
5	3.58	0.51	17.32	0.6	7.78	0.21
mean	3.2	0.75	17.28	0.75	7.81	0.14
sd	0.47	0.2	0.42	0.26	0.47	0.11
-----						
Set 3 Tumble Dry 60+10 mins						
1	3.08	0.3	19.32	0.81	7.8	0.09
2	3.2	0.32	19.44	0.74	7.49	0.08
3	3.68	0.41	19.44	0.25	7.47	0.06
4	4	0.47	19.32	0.41	7.42	0.03
5	4.28	0.33	19.8	0.7	7.15	0.02
mean	3.65	0.37	19.46	0.58	7.47	0.06
sd	0.51	0.07	0.2	0.24	0.23	0.03
-----						
Set 5 Tumble Dry 80+10 mins						
1	3.2	0.47	18.34	0.42	7.39	0.05
2	3.2	0.68	18.38	0.45	7.4	0.07
3	4.08	0.44	17.96	0.72	7.36	0.06
4	4.56	0.86	18.14	0.41	7	0.05
5	4.64	0.82	18.3	0.45	7.14	0.08
mean	3.94	0.65	18.22	0.49	7.26	0.06
sd	0.71	0.19	0.17	0.13	0.18	0.01
-----						
Set 7 Tumble Dry 100+10 mins						
1	3	0.57	19.12	0.71	7.2	0.12
2	3.28	0.63	19.16	1.06	7.44	0.16
3	3.92	0.73	18.6	1.18	7.22	0.12
4	4.16	0.71	19.04	0.38	7.13	0.13
5	4.36	0.91	18.4	0.64	6.96	0.1
mean	3.74	0.71	18.86	0.79	7.19	0.13
sd	0.58	0.13	0.34	0.32	0.17	0.02
-----						
Set 8 Line Dry 24hrs Conditioned Atmosphere						
1	-0.68	0.67	14.2	1.48	9.14	0.09
2	-1.18	0.3	13.86	1.11	9.37	0.07
3	-1.2	0.62	14.34	1.01	9.06	0.06
4	-1.26	0.59	13.82	1.33	8.78	0.1
5	-1.48	0.62	13.96	1.16	9.3	0.09
mean	-1.16	0.56	14.04	1.22	9.13	0.08
sd	0.29	0.15	0.23	0.19	0.23	0.02

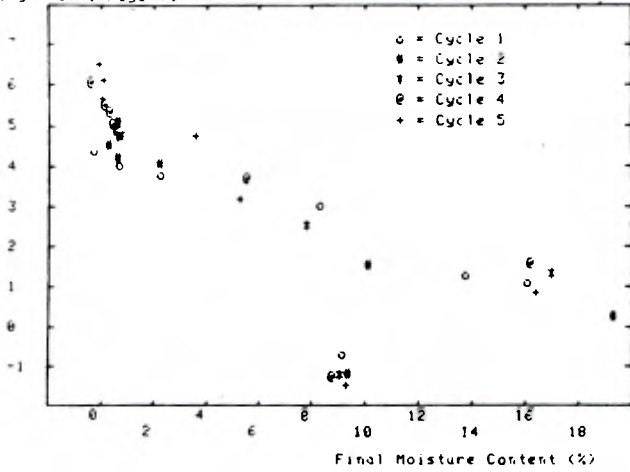
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Measured immediately  
 Length Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyrostock



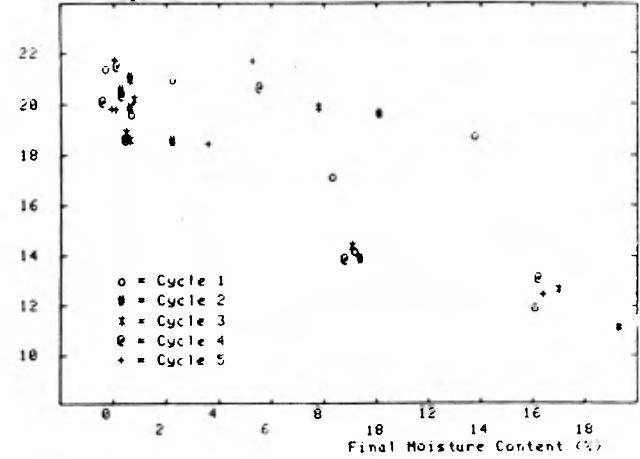
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Measured immediately  
 Width Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyrostock



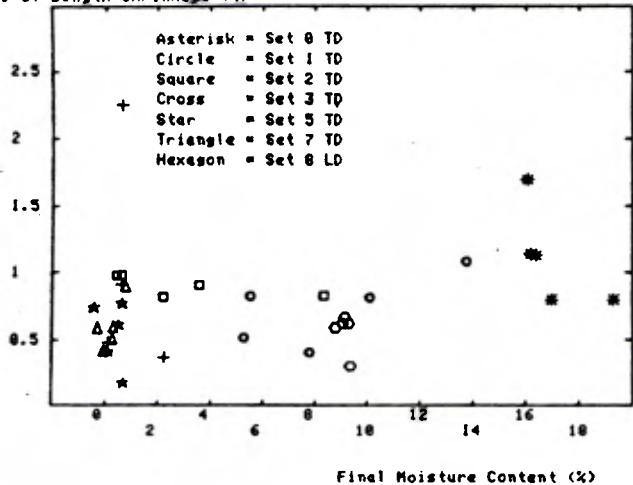
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Measured immediately  
 Length Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyrostock



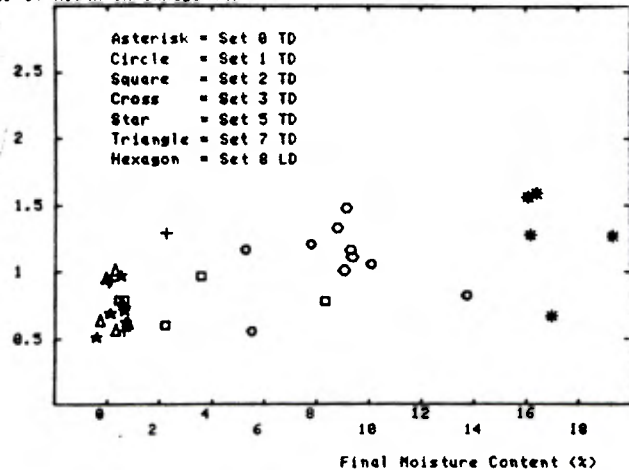
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Measured immediately  
 Width Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyrostock



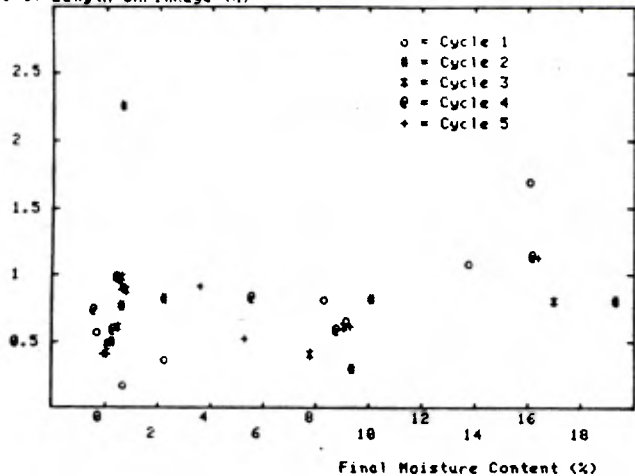
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Measured immediately  
SD of Length Shrinkage (%) 28g Single Jersey 2/72/287 Merc + Gyro



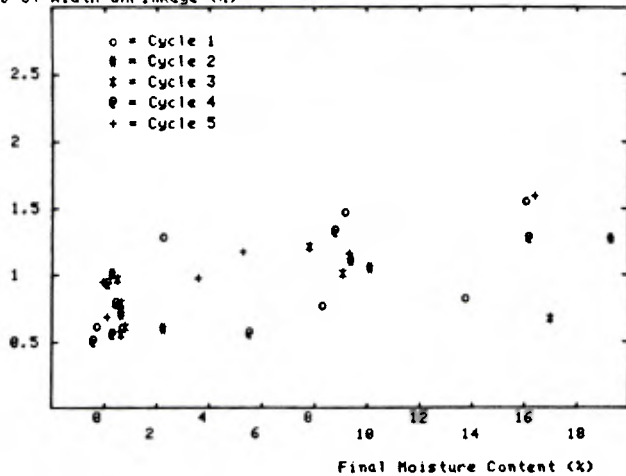
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Measured immediately  
SD of Width Shrinkage (%) 28g Single Jersey 2/72/287 Merc + Gyro



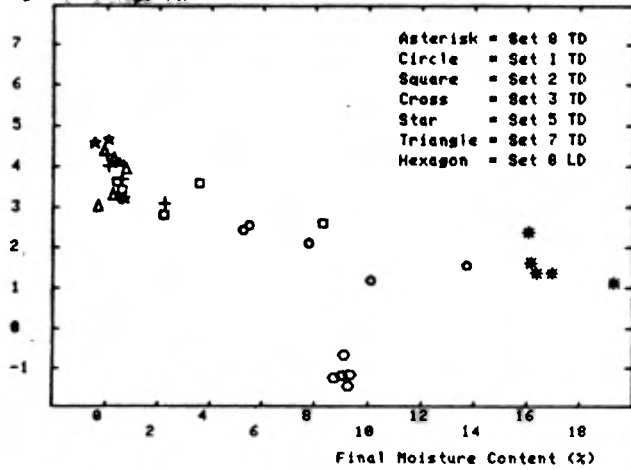
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Measured immediately  
SD of Length Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyro



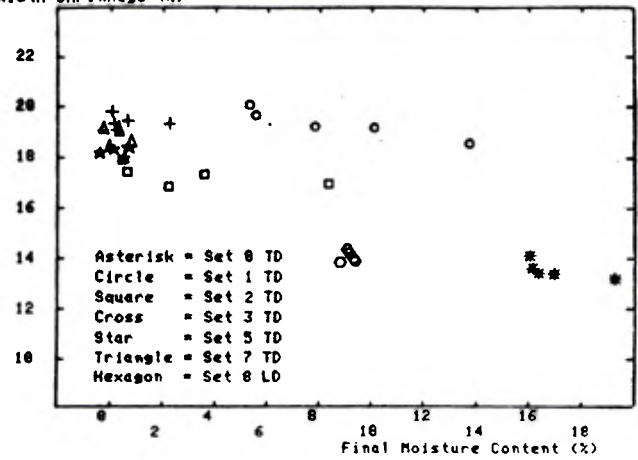
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Measured immediately  
SD of Width Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyro



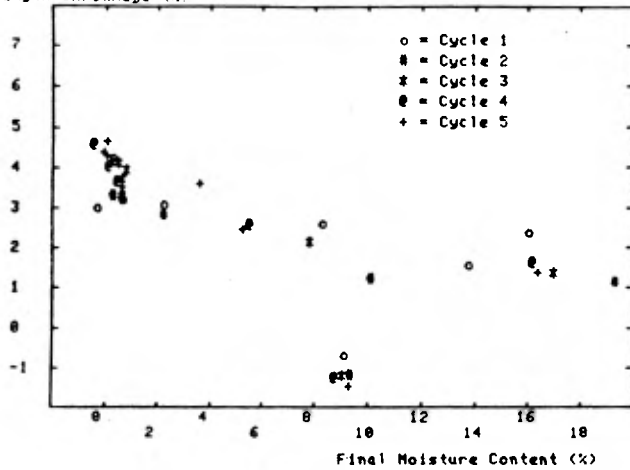
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : After Conditioning  
 Length Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyrostock



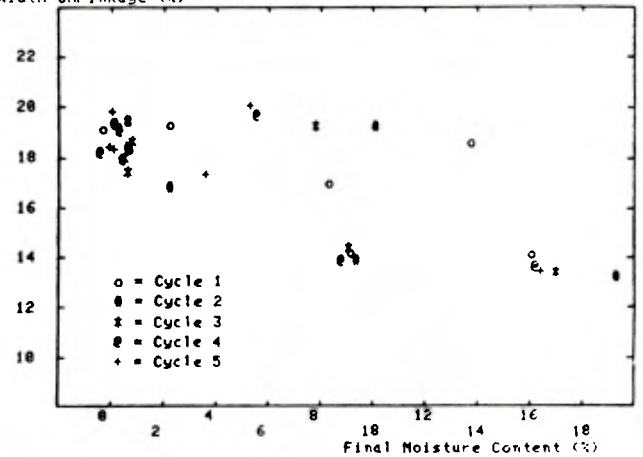
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : After Conditioning  
 Width Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyrostock



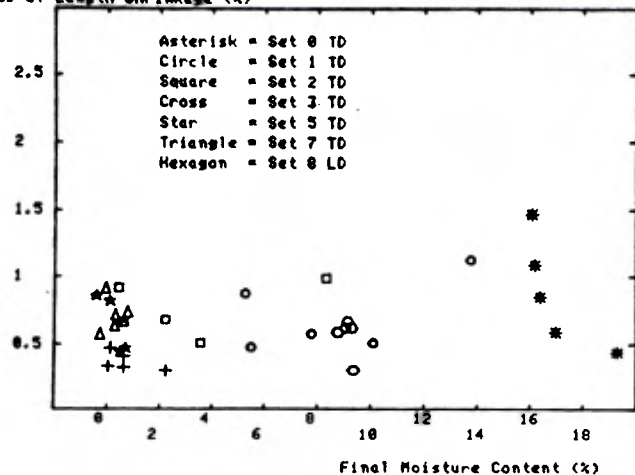
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : After Conditioning  
 Length Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyrostock



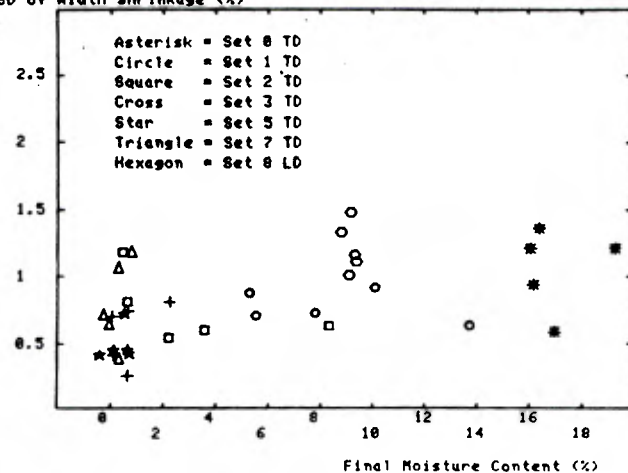
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : After Conditioning  
 Width Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyrostock



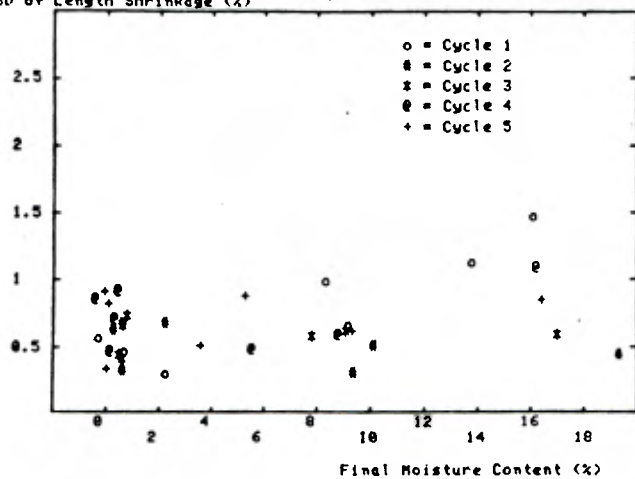
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : After Conditioning  
SD of Length Shrinkage (%) 28g Single Jersey 2/72/287 Merc + Gyro



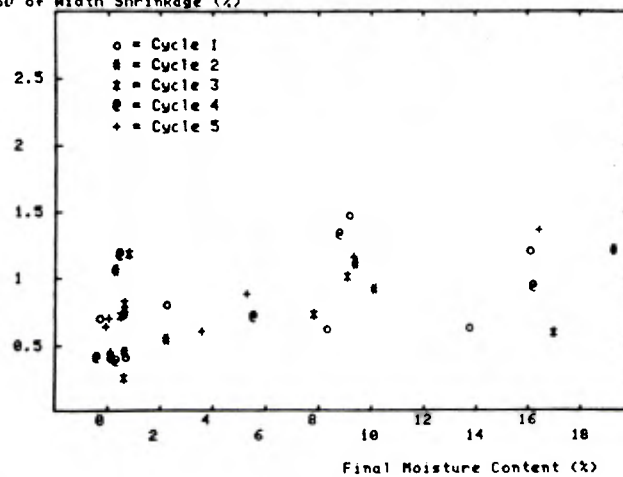
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : After Conditioning  
SD of Width Shrinkage (%) 28g Single Jersey 2/72/287 Merc + Gyro



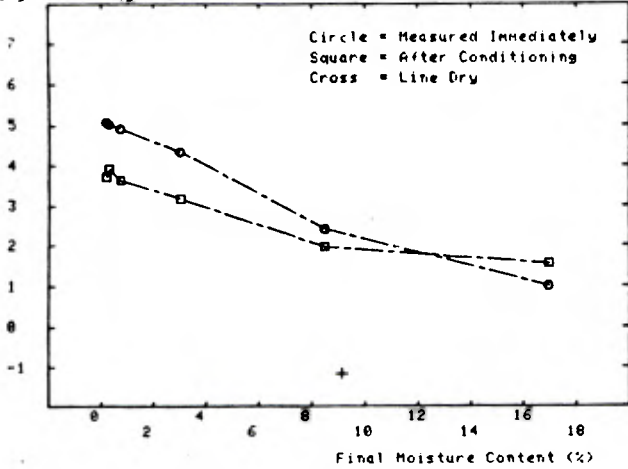
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : After Conditioning  
SD of Length Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyro



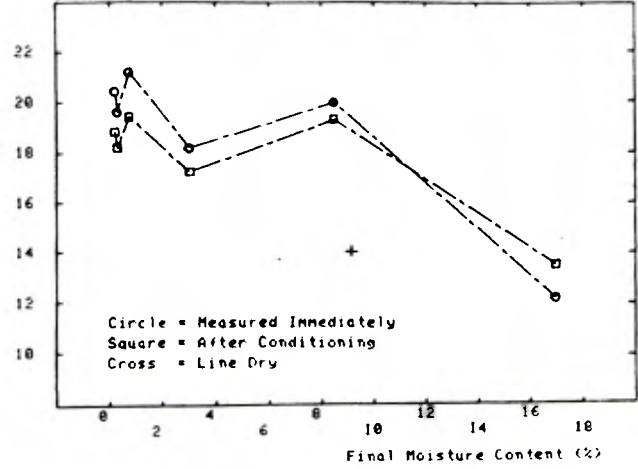
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : After Conditioning  
SD of Width Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyro



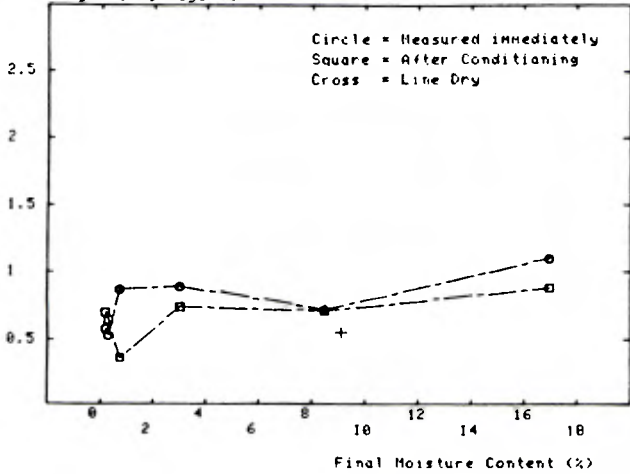
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Average of 5 Cycles  
Length Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyroslock



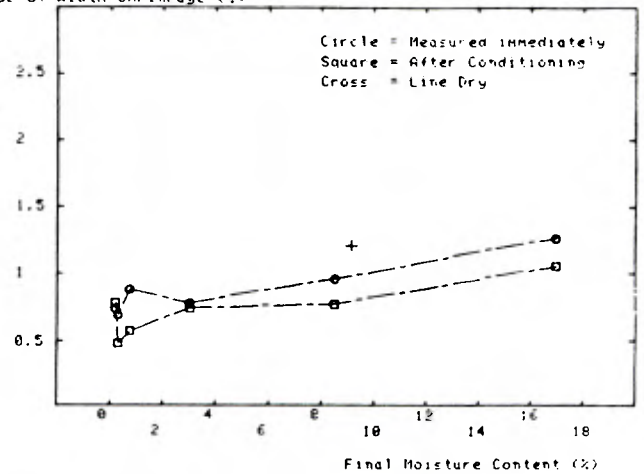
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Average of 5 Cycles  
Width Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyroslock



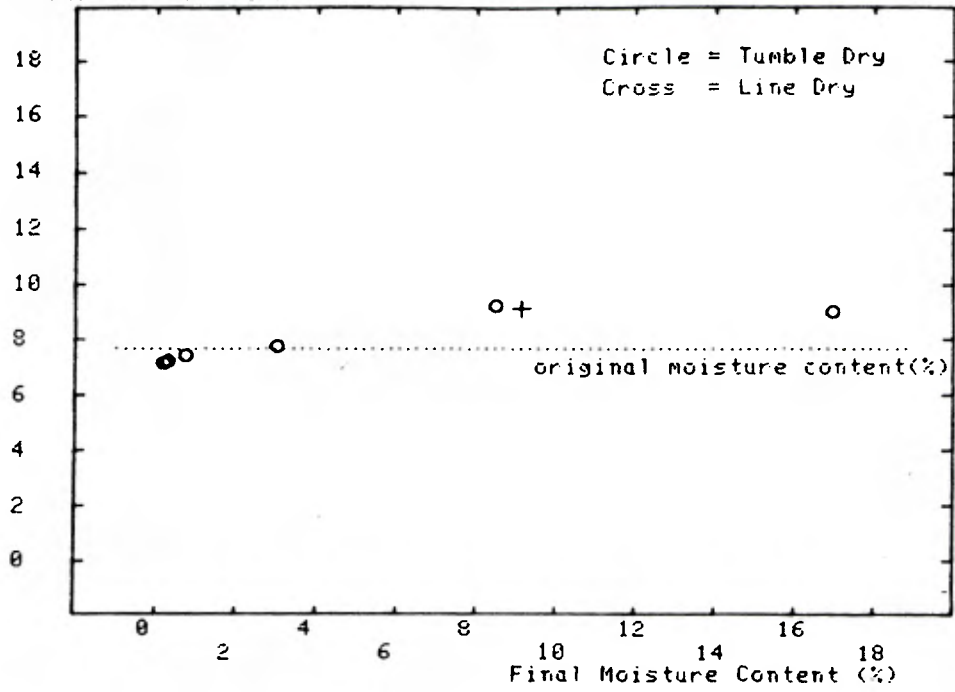
SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Average of 5 Cycles  
SD of Length Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyroslock



SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Average of 5 Cycles  
SD of Width Shrinkage (%) 28g Single Jersey 2/72/287 Merc+Gyroslock



SHRINKAGE IN TUMBLE DRYING : TRIAL 3 : Average of 5 Cycles  
Conditioned M.C. (%) 29g Single Jersey 2/72/287 Merc+Gyrstock



## SHRINKAGE IN TUMBLE DRYING

TRIAL 4 : 1x1 RIB, Ne 1/30, SL 0.282, WINCH BLEACH

Average of five replications : Measured immediately

Cycle No	LS%	SD	WS%	SD	MC%	SD
-----						
Set 1 Tumble Dry 40+10 mins						
1	2.62	0.67	0.14	1.12	20.22	3.07
2	3.42	0.97	2.06	2.28	13.04	4.72
3	3.76	0.8	2.78	1.86	11.5	3.73
4	3.46	0.49	1.32	1.18	14.06	1.53
5	4.42	0.62	1.56	0.91	11.25	1.47
mean	3.54	0.71	1.57	1.47	14.01	2.9
sd	0.65	0.18	0.98	0.58	3.65	1.41
Set 2 Tumble Dry 50+10 mins						
1	4.18	1.51	3.1	1.96	10.45	3.36
2	6.94	0.27	8.06	0.88	2.46	0.19
3	5.86	1.05	6.66	1.39	6.9	2.3
4	7.1	0.23	8.12	1.02	3.45	0.22
5	7.54	0.22	7.82	0.82	2.51	0.48
mean	6.32	0.66	6.75	1.21	5.15	1.31
sd	1.35	0.59	2.13	0.47	3.47	1.44
Set 3 Tumble Dry 60+10 mins						
1	6.58	0.61	7.4	0.68	1.52	0.06
2	7.56	0.41	7.32	1.14	0.62	0.56
3	7.9	0.64	8.06	0.61	0.96	0.03
4	8.14	0.61	7.9	0.46	0.86	0.21
5	8.36	0.3	7.86	1.13	0.85	0.11
mean	7.71	0.51	7.71	0.8	0.96	0.19
sd	0.7	0.15	0.33	0.31	0.34	0.22
Set 5 Tumble Dry 80+10 mins						
1	6.86	0.42	8.48	0.61	1.33	0.13
2	7.5	0.26	8.84	0.71	1.17	0.2
3	7.52	0.28	9.5	0.53	1.29	0.33
4	8.2	0.32	9.58	0.16	0.78	0.11
5	8.18	0.18	9.58	0.3	0.77	0.15
mean	7.65	0.29	9.2	0.46	1.07	0.18
sd	0.56	0.09	0.51	0.23	0.27	0.09
Set 7 Tumble Dry 100+10 mins						
1	6.72	0.25	7.16	0.61	1.34	0.07
2	7.22	0.43	7.32	0.73	1.69	0.43
3	7.52	0.3	7.4	0.52	1.46	0.09
4	8.24	0.38	6.62	0.78	1.33	0.14
5	8.72	0.27	6.94	0.97	0.75	0.29
mean	7.68	0.33	7.09	0.72	1.31	0.2
sd	0.8	0.08	0.32	0.17	0.35	0.15
Set 8 Line Dry 24hrs Conditioned Atmosphere						
1	3.84	0.27	-0.06	1.42	7.83	0.04
2	3.86	0.58	-1.28	1.45	7.75	0.03
3	3.7	0.48	-0.62	0.16	7.7	0.05
4	4.46	0.38	-2.1	0.36	7.87	0.31
5	4.7	0.68	-2.6	1.42	7.46	0.03
mean	4.11	0.48	-1.33	0.96	7.72	0.09
sd	0.44	0.16	1.04	0.64	0.16	0.12

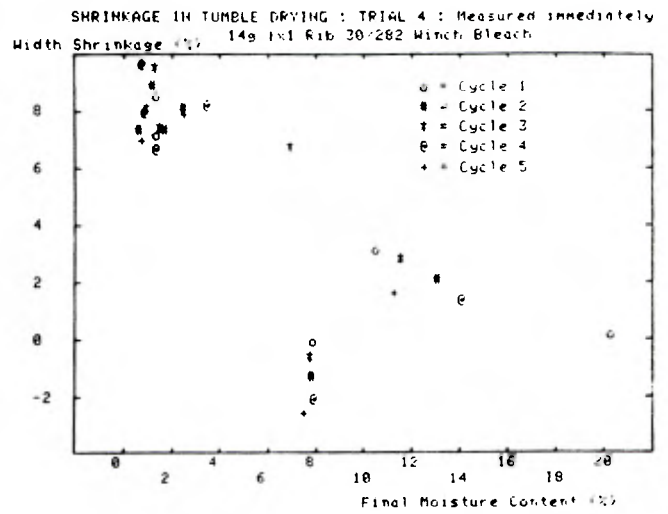
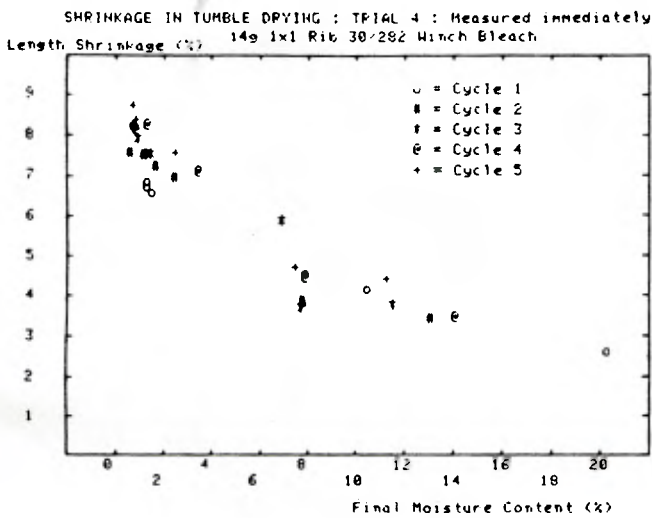
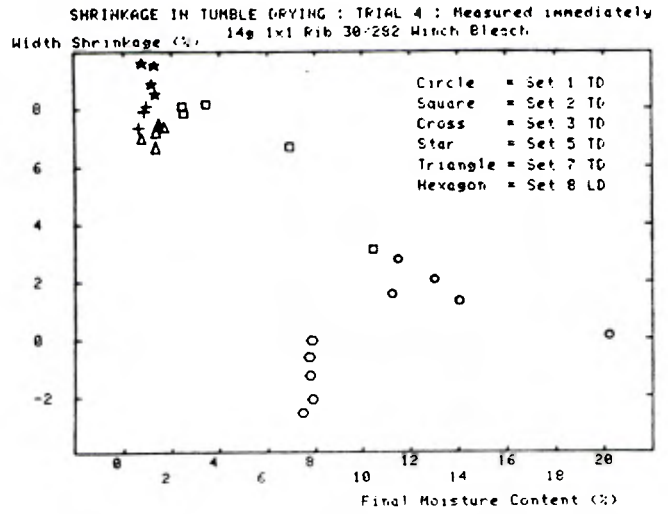
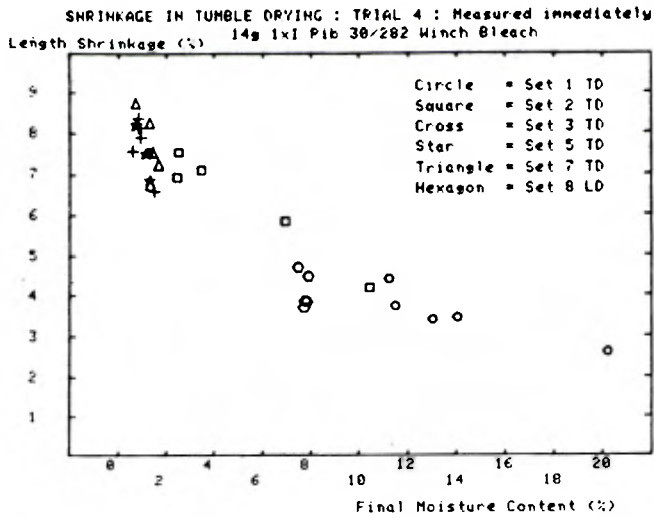


## SHRINKAGE IN TUMBLE DRYING

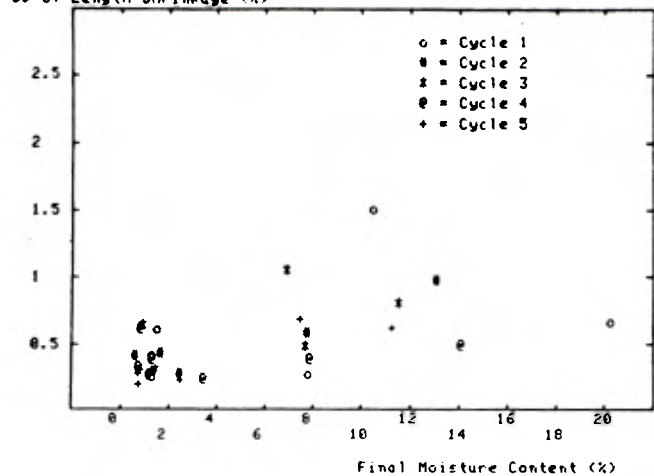
TRIAL 4 : 1x1 RIB, Ne 1/30, SL 0.282, WINCH BLEACH

Average of five replications : Measured after conditioning

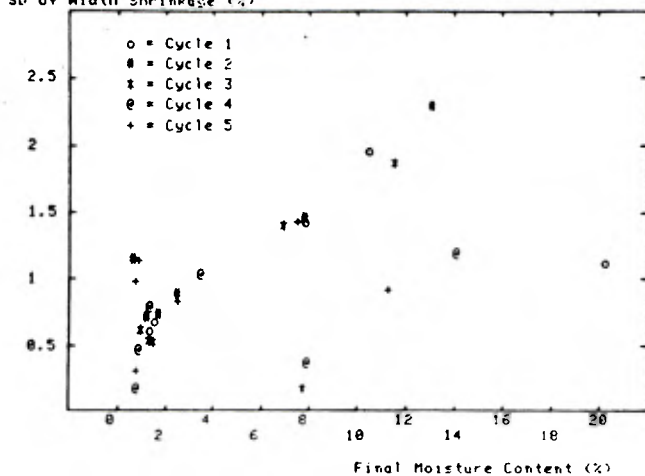
Cycle No	LS%	SD	WS%	SD	MC%	SD
-----						
Set 1 Tumble Dry 40+10 mins						
1	3.34	0.31	2.24	1.37	7.59	0.04
2	4	0.68	2.14	1.78	7.56	0.1
3	3.84	0.35	2.7	1.12	7.29	0.22
4	4.12	0.33	1.94	1.02	7.45	0.05
5	4.16	0.5	2.74	0.86	7.55	0.08
mean	3.89	0.43	2.35	1.23	7.49	0.1
sd	0.33	0.16	0.35	0.36	0.12	0.07
Set 2 Tumble Dry 50+10 mins						
1	4.56	0.51	3.3	1.31	7.48	0.12
2	5.74	0.36	6.46	0.54	6.48	0.07
3	5.34	0.44	4.92	1.6	7.21	0.33
4	6.02	0.26	6.38	1.02	6.63	0.05
5	6.62	0.36	6.16	0.54	6.44	0.15
mean	5.66	0.39	5.44	1	6.85	0.14
sd	0.77	0.09	1.35	0.47	0.47	0.11
Set 3 Tumble Dry 60+10 mins						
1	5.24	0.69	5.62	0.88	6.23	0.02
2	6.04	0.58	5.74	0.71	6.3	0.06
3	6.46	0.17	5.78	0.57	6.28	0.34
4	6.72	0.58	6.46	0.93	6.15	0.05
5	6.44	0.84	6.2	0.85	6.19	0.03
mean	6.18	0.57	5.96	0.79	6.23	0.1
sd	0.58	0.25	0.35	0.15	0.06	0.14
Set 5 Tumble Dry 80+10 mins						
1	5.46	0.27	7.86	0.61	6.55	0.09
2	5.84	0.5	6.96	0.8	6.56	0.07
3	6.44	0.3	7.14	0.26	6.31	0.02
4	6.78	0.26	7.64	0.41	6.24	0.01
5	7.2	0.16	7.98	0.44	6.21	0.05
mean	6.34	0.3	7.52	0.5	6.37	0.05
sd	0.7	0.12	0.45	0.21	0.17	0.03
Set 7 Tumble Dry 100+10 mins						
1	5.34	0.59	5.3	0.45	6.43	0.04
2	6.06	0.56	5.1	0.29	6.44	0.06
3	6.42	0.36	5.74	0.83	6.23	0.03
4	7.12	0.25	5.38	0.51	6.05	0.05
5	7.66	0.22	5.14	0.61	6.04	0.01
mean	6.52	0.4	5.33	0.54	6.24	0.04
sd	0.9	0.17	0.26	0.2	0.2	0.02
Set 8 Line Dry 24hrs Conditioned Atmosphere						
1	3.84	0.27	-0.06	1.42	7.83	0.04
2	3.86	0.58	-1.28	1.45	7.75	0.03
3	3.7	0.48	-0.62	0.16	7.6	0.05
4	4.46	0.38	-2.1	0.36	7.87	0.31
5	4.7	0.68	-2.6	1.42	7.46	0.03
mean	4.11	0.48	-1.33	0.96	7.7	0.09
sd	0.44	0.16	1.04	0.64	0.17	0.12



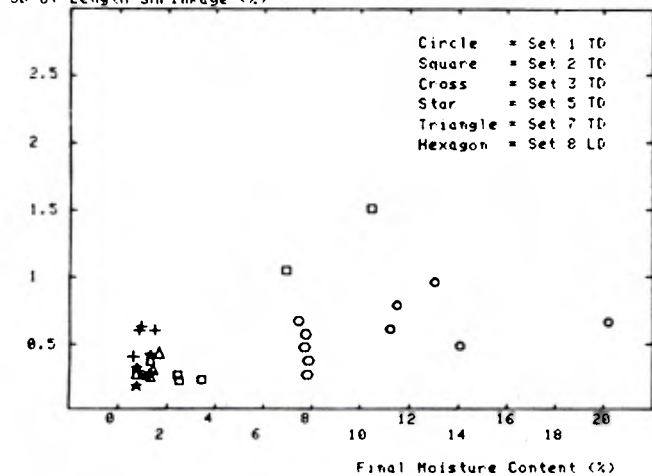
SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : Measured immediately  
 14g 1x1 Rib 30/282 Winch Bleach



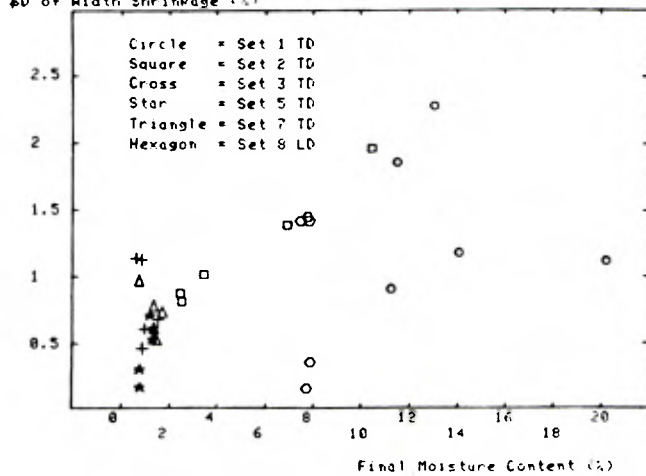
SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : Measured immediately  
 14g 1x1 Rib 30/282 Winch Bleach



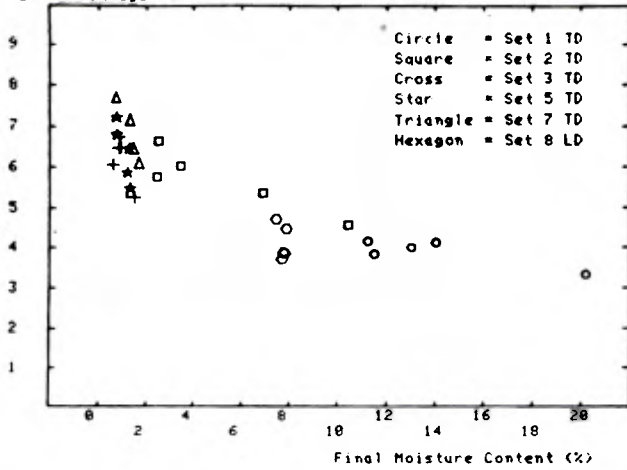
SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : Measured immediately  
 14g 1x1 Rib 30/282 Winch Bleach



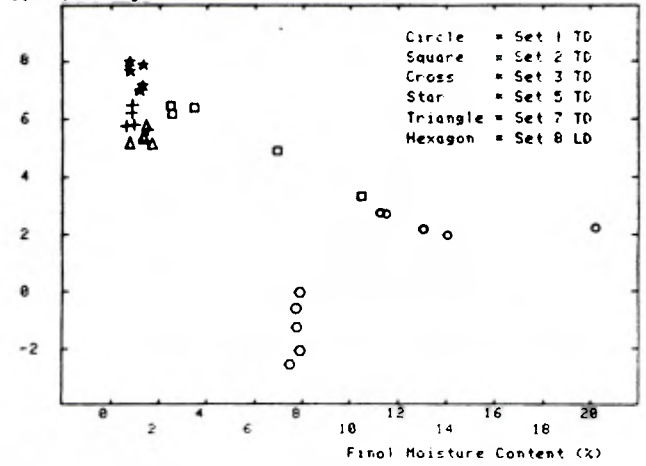
SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : Measured immediately  
 14g 1x1 Rib 30/282 Winch Bleach



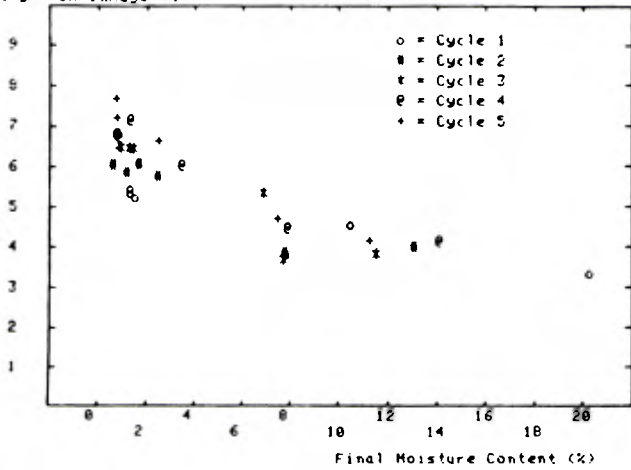
SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : After Conditioning  
 Length Shrinkage (%) 14g 1x1 Rib 30/282 Winch Bleach



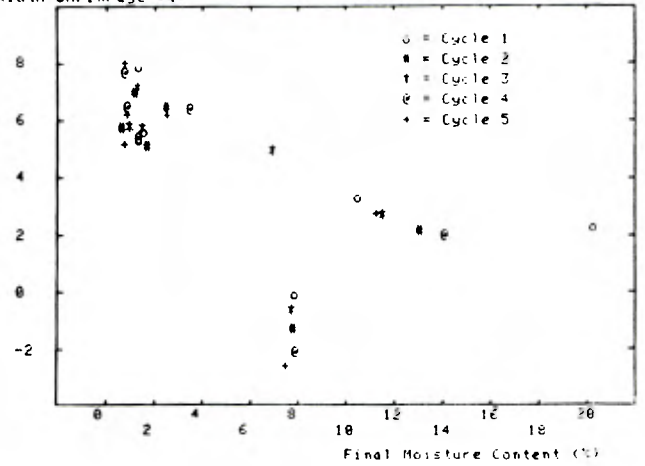
SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : After Conditioning  
 Width Shrinkage (%) 14g 1x1 Rib 30/282 Winch Bleach

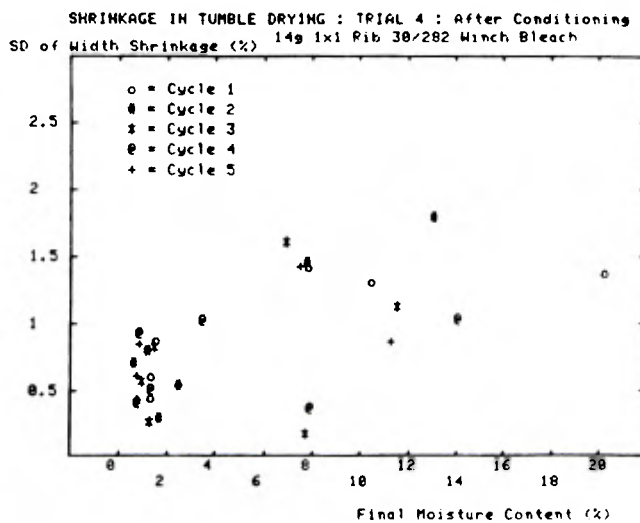
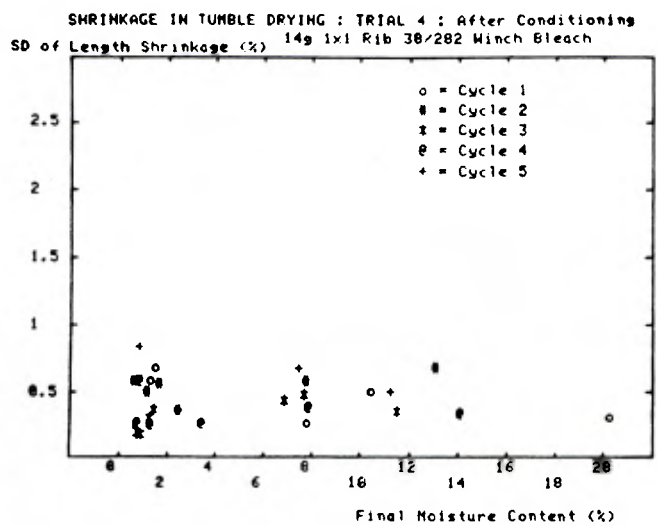
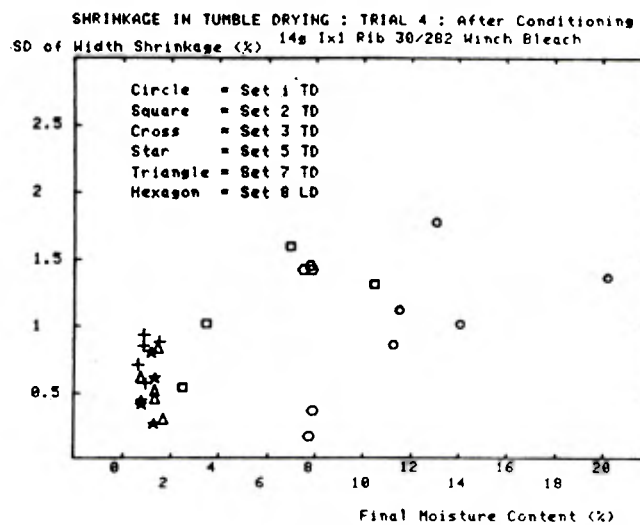
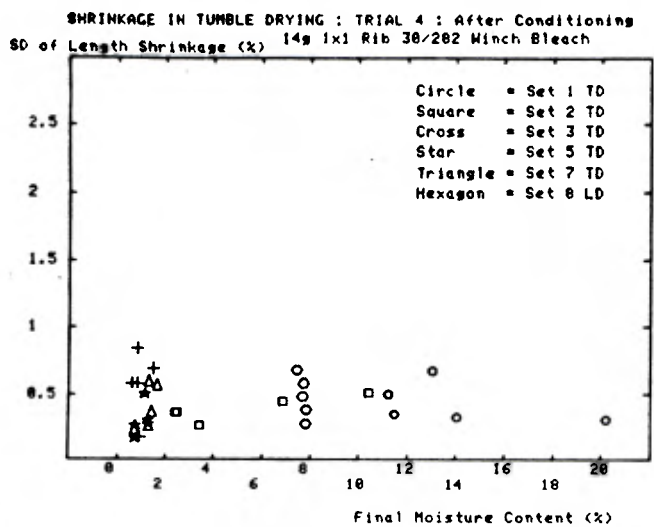


SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : After Conditioning  
 Length Shrinkage (%) 14g 1x1 Rib 30/282 Winch Bleach

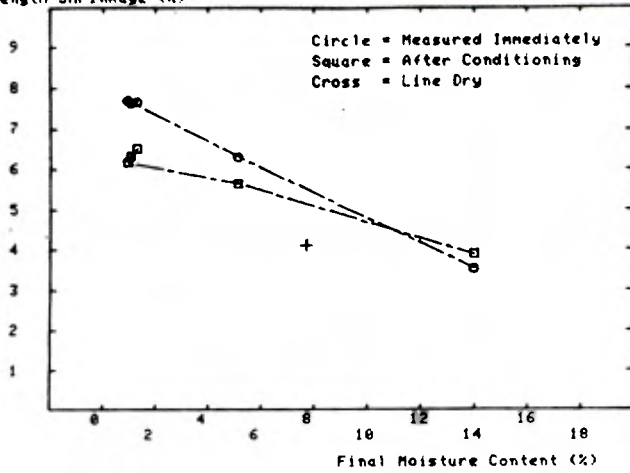


SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : After Conditioning  
 Width Shrinkage (%) 14g 1x1 Rib 30/282 Winch Bleach

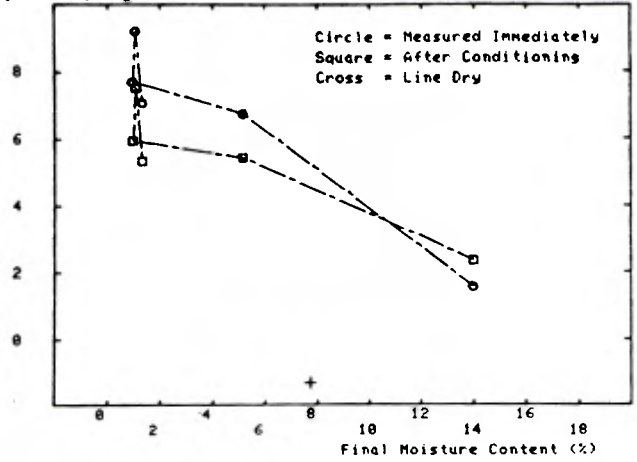




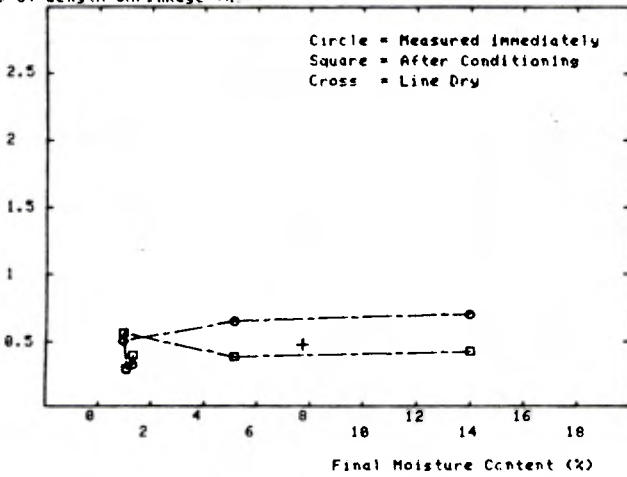
SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : Average of 5 Cycles  
Length Shrinkage (%) 14g 1x1 Rib 30/282 Winch Bleach



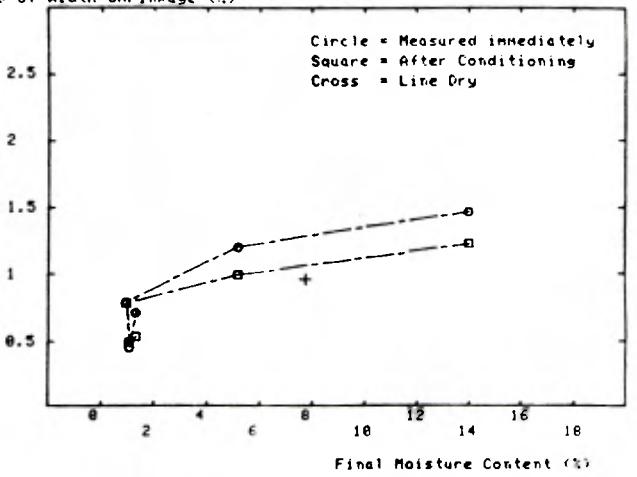
SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : Average of 5 Cycles  
Width Shrinkage (%) 14g 1x1 Rib 30/282 Winch Bleach



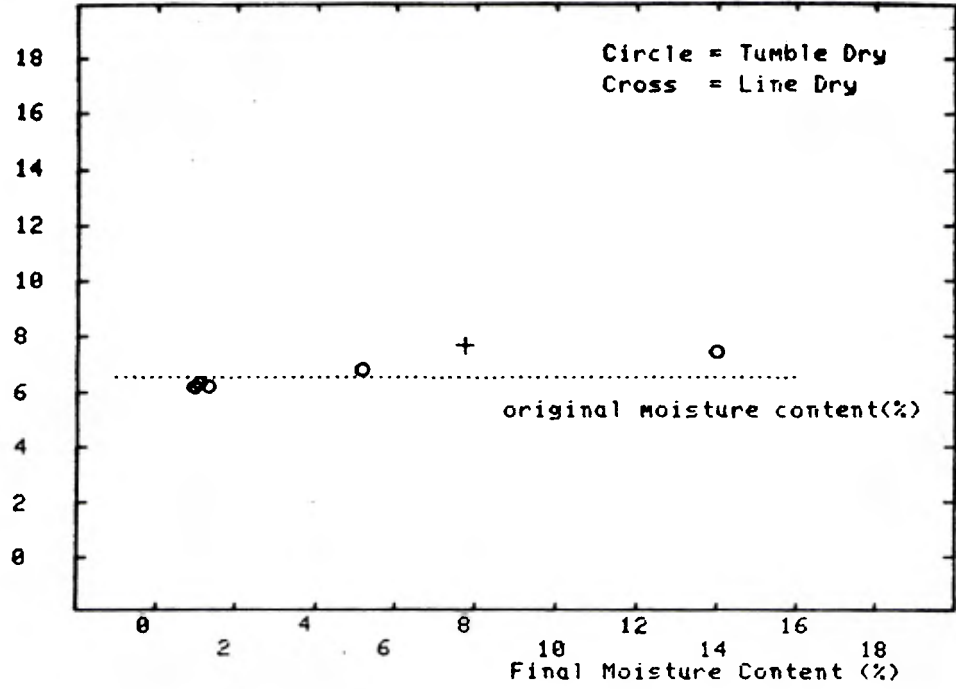
SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : Average of 5 Cycles  
SD of Length Shrinkage (%) 14g 1x1 Rib 30/282 Winch Bleach



SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : Average of 5 Cycles  
SD of Width Shrinkage (%) 14g 1x1 Rib 30/282 Winch Bleach



SHRINKAGE IN TUMBLE DRYING : TRIAL 4 : Average of 5 Cycles  
14g 1x1 Rib 30/282 Winch Bleach  
Conditioned M.C. (%)



## SHRINKAGE IN TUMBLE DRYING

TRIAL 5 : 28g SINGLE JERSEY, Ne 2/72, SL 0.287cm, GYROSTOCK DYED

Average of five replications : Measured immediately

Cycle No	LSZ	SD	WSZ	SD	MCZ	SD	
Set 0 Tumble Dry 30+10 mins							
1	4.38	1.39	2.76	0.84	16.16	1.65	
2	4.8	1.16	0.72	1.25	32.73	3.03	
3	5.68	1.06	4.4	1.97	14.14	5.13	
4	5.1	0.75	3.14	1.81	17.24	2.67	
5	5.22	0.66	1.3	0.93	21.74	5.68	
	mean	5.04	1	2.46	1.36	20.4	3.63
	sd	0.48	0.3	1.47	0.51	7.43	1.71
Set 1 Tumble Dry 40+10 mins							
1	5.14	0.66	3.28	1.12	16.12	2.4	
2	7.18	0.83	7.52	3.18	9.08	2.91	
3	7.78	0.46	7.5	1.41	8.45	1.19	
4	9.48	0.49	9.64	1.42	4.17	0.3	
5	7.06	1.38	6.64	3.28	11.54	3.96	
	mean	7.33	0.76	6.92	2.08	9.87	2.15
	sd	1.56	0.37	2.31	1.06	4.39	1.44
Set 2 Tumble Dry 50+10 mins							
1	8.36	0.57	9.96	0.65	2.48	0.13	
2	9.54	0.52	10.78	0.51	1.21	0.15	
3	9.72	0.75	10.78	0.62	1.42	0.09	
4	9.88	0.41	11.3	0.67	1.04	0.16	
5	8.7	0.49	9.36	0.53	7.38	1.14	
	mean	9.24	0.55	10.44	0.6	2.71	0.33
	sd	0.67	0.13	0.77	0.07	2.67	0.45
Set 3 Tumble Dry 60+10 mins							
1	8.84	0.19	10.26	0.88	1.1	0.15	
2	9.4	0.4	10.52	0.97	0.88	0.17	
3	9.4	0.66	10.48	1.61	1.25	0.19	
4	9.22	0.89	10.46	1.27	1.49	0.25	
5	9.24	0.36	10.38	0.97	2.78	0.13	
	mean	9.22	0.5	10.42	1.14	1.5	0.18
	sd	0.23	0.28	0.1	0.3	0.75	0.05
Set 5 Tumble Dry 80+10 mins							
1	8.12	0.47	9.3	0.86	2.36	0.14	
2	9.24	0.38	10.74	0.92	1.17	0.16	
3	9.12	0.64	10.32	0.89	1.43	0.34	
4	9.78	0.7	11.02	1.24	0.92	0.19	
5	10.04	0.47	11.28	1.05	0.87	0.16	
	mean	9.26	0.53	10.53	0.99	1.35	0.2
	sd	0.74	0.13	0.78	0.16	0.61	0.08
Set 7 Tumble Dry 100+10 mins							
1	8.52	0.52	10.14	0.62	1.22	0.17	
2	9.36	0.61	11.26	0.58	0.56	0.16	
3	9.08	0.3	10.54	0.34	0.92	0.07	
4	9.82	0.38	11.12	0.73	0.99	0.16	
5	10.02	0.63	11.64	0.56	0.36	0.18	
	mean	9.36	0.49	10.94	0.57	0.81	0.15
	sd	0.6	0.14	0.6	0.14	0.35	0.04
Set 8 Line Dry 24hrs Conditioned Atmosphere							
1	3.62	0.93	5.64	0.99	7.21	0.08	
2	3.8	0.45	5.4	0.89	7.2	0.07	
3	3.9	1.1	5.92	0.82	7.13	0.14	
4	4.28	0.99	4.54	1.5	7.26	0.04	
5	4.36	0.69	5.08	0.82	6.62	0.09	
	mean	3.99	0.83	5.32	1	7.08	0.08
	sd	0.32	0.26	0.53	0.29	0.26	0.04



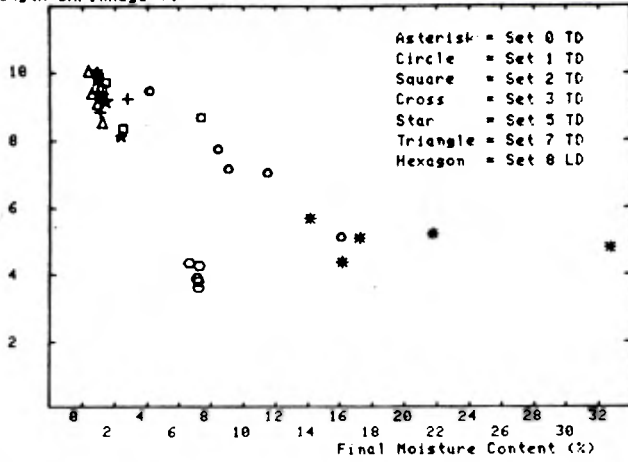
## SHRINKAGE IN TUMBLE DRYING

TRIAL 5 : 28g SINGLE JERSEY, Ne 2/72, SL 0.287cm, GYROSTOCK DYED

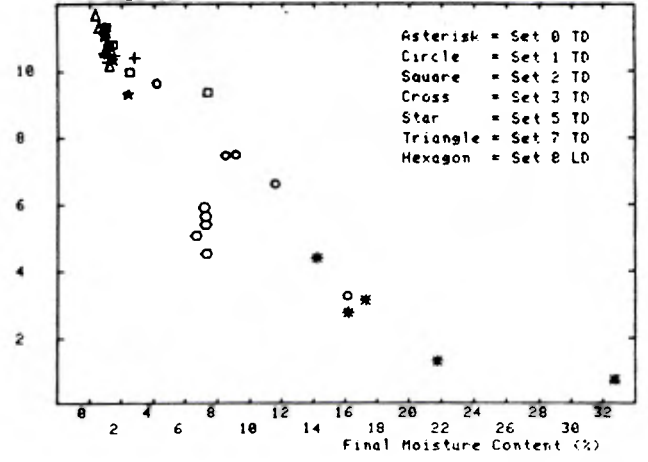
Average of five replications : Measured after conditioning

Cycle No	LS%	SD	WS%	SD	MC%	SD
-----						
Set 0 Tumble Dry 30+10 mins						
1	5.34	0.95	5.58	1.27	7.2	0.11
2	5.32	0.97	4.3	1.11	6.49	0.1
3	6.28	0.89	5.74	1.26	6.57	0.1
4	6.42	0.6	4.8	1.21	6.51	0.07
5	6.18	0.55	3.68	1.55	6.45	0.1
mean	5.91	0.79	4.82	1.28	6.64	0.1
sd	0.53	0.2	0.87	0.16	0.31	0.02
-----						
Set 1 Tumble Dry 40+10 mins						
1	6.38	0.8	5.66	0.76	6.66	0.04
2	6.96	0.44	7.42	2.06	6.54	0.28
3	7.34	0.4	7.88	1.62	6.54	0.14
4	7.6	0.54	8.42	1.42	5.75	0.06
5	7.16	0.57	7.68	1.84	6.23	0.07
mean	7.09	0.55	7.41	1.54	6.34	0.12
sd	0.46	0.16	1.05	0.5	0.37	0.1
-----						
Set 2 Tumble Dry 50+10 mins						
1	7.12	0.53	9.02	0.44	5.65	0.06
2	7.92	0.57	9.32	0.44	5.59	0.05
3	8.18	0.46	9.44	0.58	5.14	0.05
4	8.36	0.54	9.52	0.63	5.23	0.04
5	8.16	0.6	8.9	0.58	6.19	0.19
mean	7.95	0.54	9.24	0.53	5.56	0.08
sd	0.49	0.05	0.27	0.09	0.42	0.06
-----						
Set 3 Tumble Dry 60+10 mins						
1	7.46	0.44	8.54	0.78	5.61	0.01
2	7.76	0.65	8.98	1.12	5.37	0.09
3	8	0.57	9.4	1.22	5.63	0.03
4	7.78	0.5	9.06	1.31	5.6	0.04
5	7.84	0.59	8.86	1.1	5.51	0.09
mean	7.77	0.55	8.97	1.11	5.54	0.05
sd	0.2	0.08	0.31	0.2	0.11	0.04
-----						
Set 5 Tumble Dry 80+10 mins						
1	6.86	0.55	8.2	0.66	5.61	0.07
2	7.62	0.28	8.84	0.9	5.62	0.06
3	7.9	0.48	8.72	0.87	5.71	0.05
4	8.16	0.44	9.32	0.98	5.64	0.04
5	8.24	0.55	9.64	1.47	5.44	0.02
mean	7.76	0.46	8.94	0.98	5.6	0.05
sd	0.56	0.11	0.56	0.3	0.1	0.02
-----						
Set 7 Tumble Dry 100+10 mins						
1	6.96	0.31	9.06	0.38	5.63	0.08
2	7.42	0.33	9.3	0.45	5.45	0.08
3	8.02	0.3	9.54	0.47	5.49	0.11
4	8.16	0.23	9.68	0.44	5.35	0.05
5	8.64	0.43	9.4	1.03	5.35	0.06
mean	7.84	0.32	9.4	0.55	5.45	0.08
sd	0.66	0.07	0.24	0.27	0.12	0.02
-----						
Set 8 Line Dry 24hrs Conditioned Atmosphere						
1	3.62	0.93	5.64	0.99	7.21	0.08
2	3.8	0.45	5.4	0.89	7.2	0.07
3	3.9	1.1	5.92	0.82	7.13	0.14
4	4.28	0.99	4.54	1.5	7.26	0.04
5	4.36	0.69	5.08	0.82	6.62	0.09
mean	3.99	0.83	5.32	1	7.08	0.08
sd	0.32	0.26	0.53	0.29	0.26	0.04

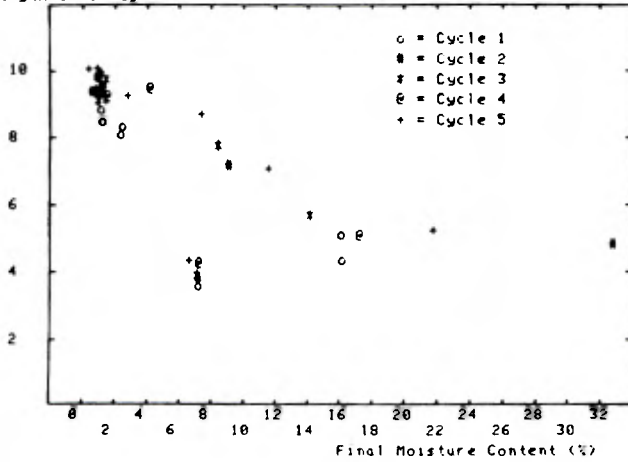
SHRINKAGE IN TUMBLE DRYING : TRIAL 5 : Measured immediately  
Length Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



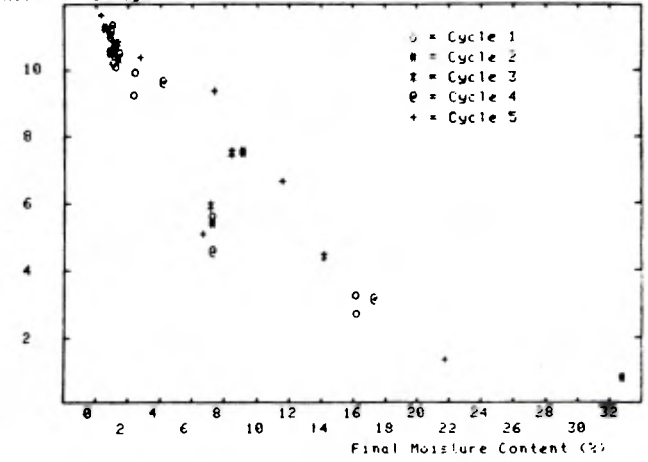
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Width Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



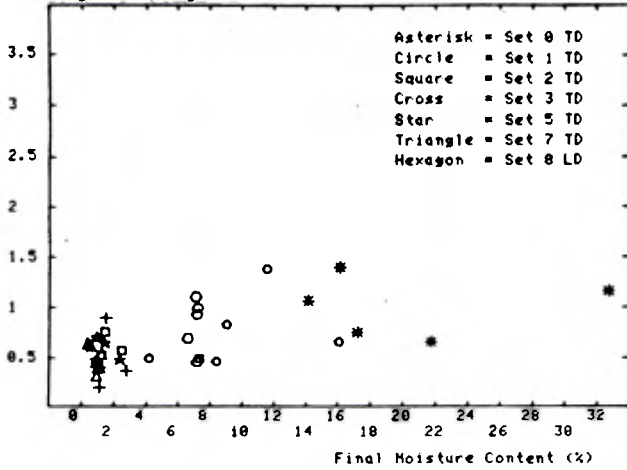
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Length Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



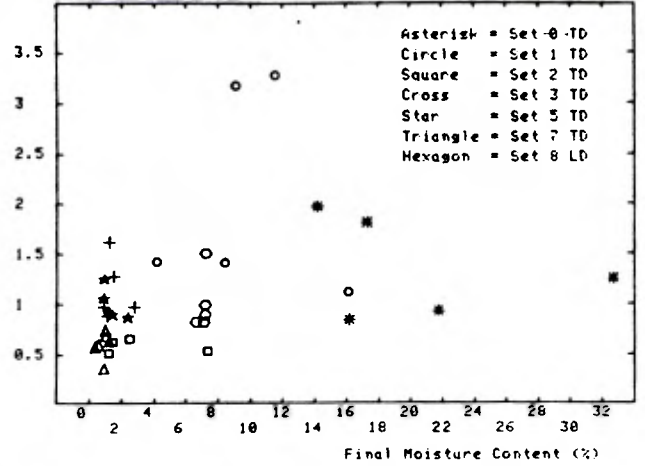
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Width Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



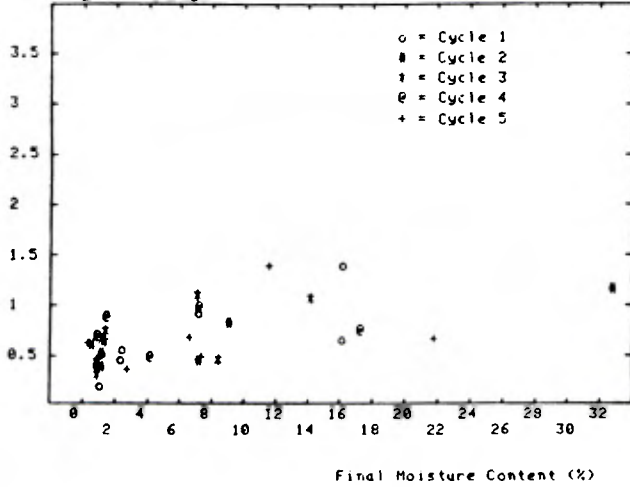
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SD of Length Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



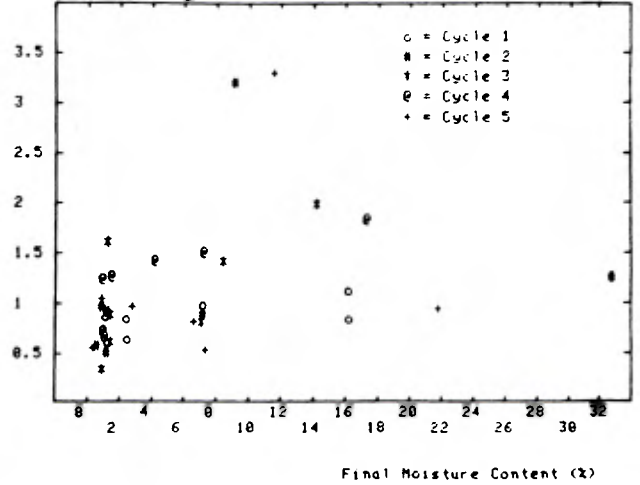
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SD of Width Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



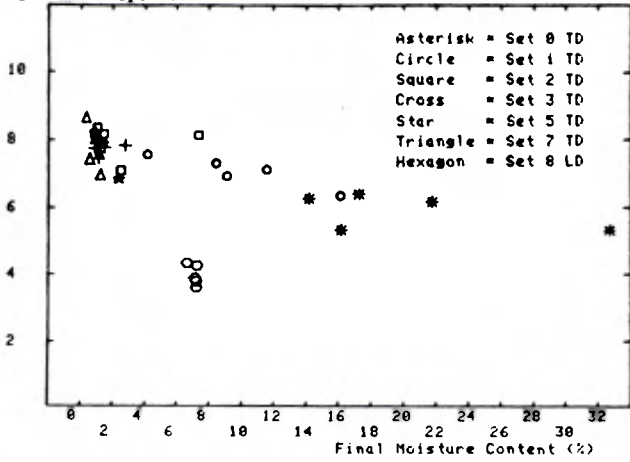
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SD of Length Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



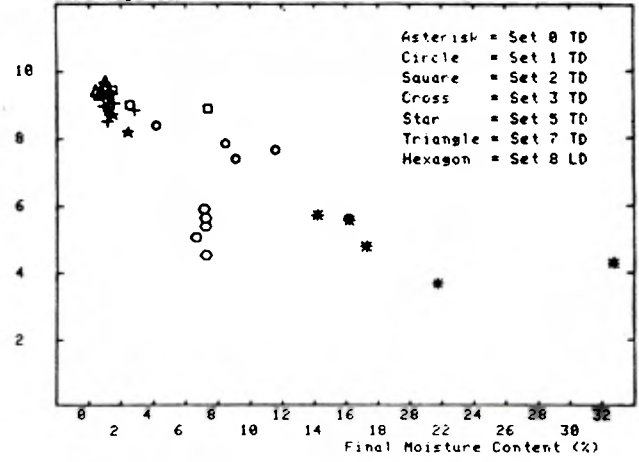
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SD of Width Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



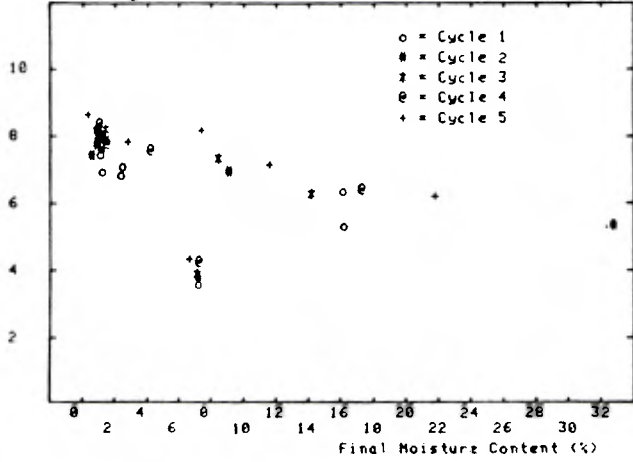
SHRINKAGE IN TUMBLE DRYING : TRIAL 5 : After Conditioning  
 Length Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



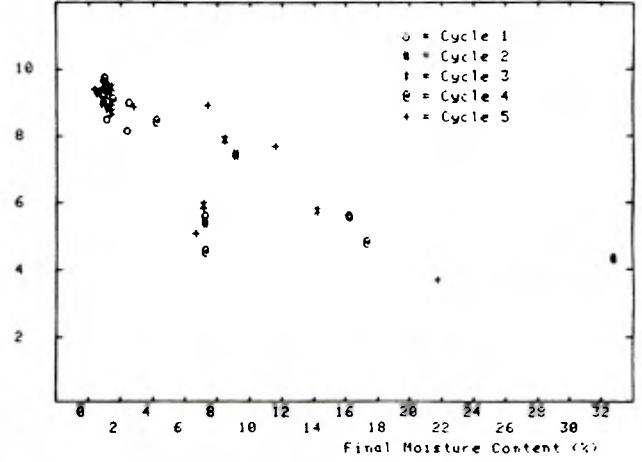
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 Width Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



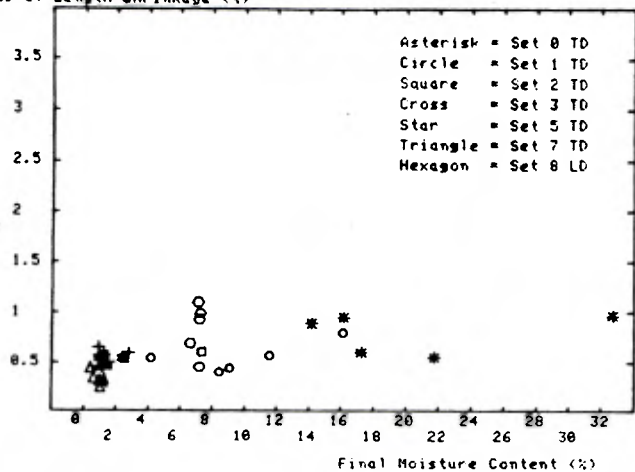
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 Length Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



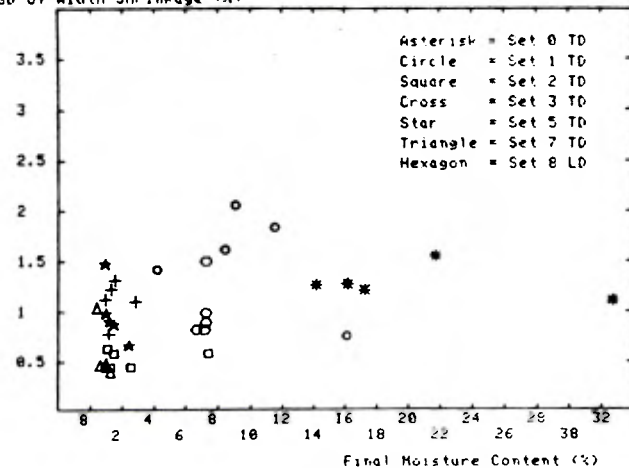
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 Width Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



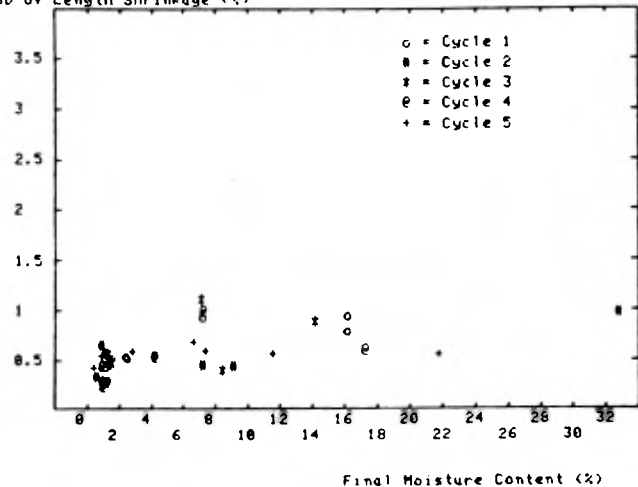
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SD of Length Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



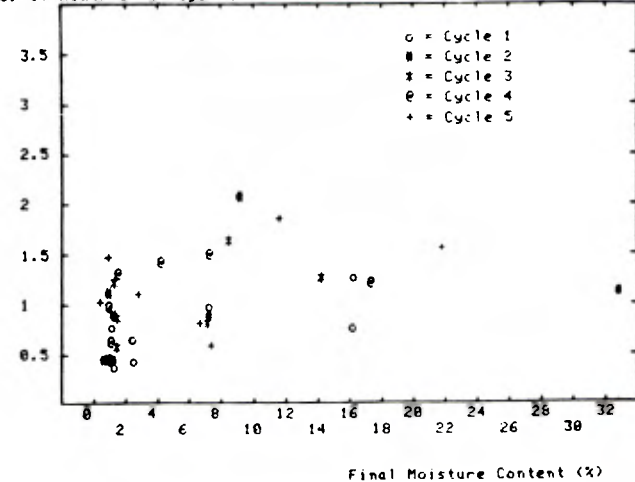
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SD of Width Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



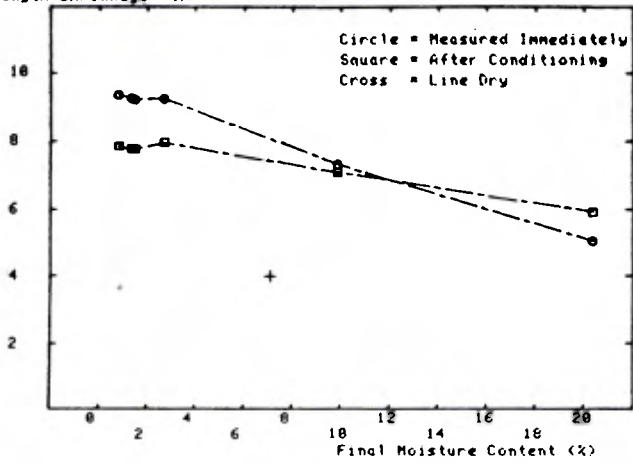
SHRINKAGE IN TUMBLE DRYING : TRIAL 5 : After Conditioning  
SD of Length Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



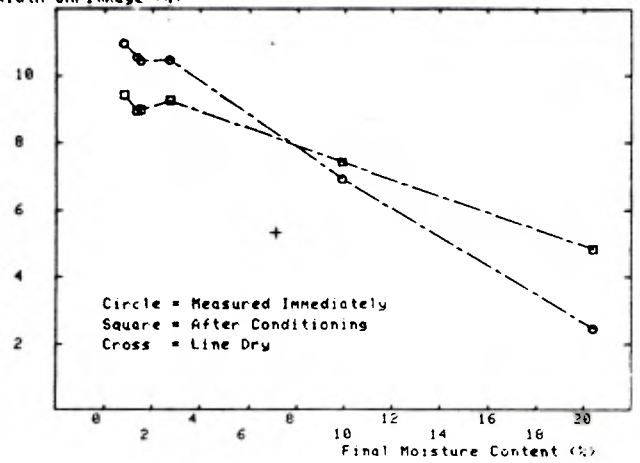
SHRINKAGE IN TUMBLE DRYING : TRIAL 5 : After Conditioning  
SD of Width Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



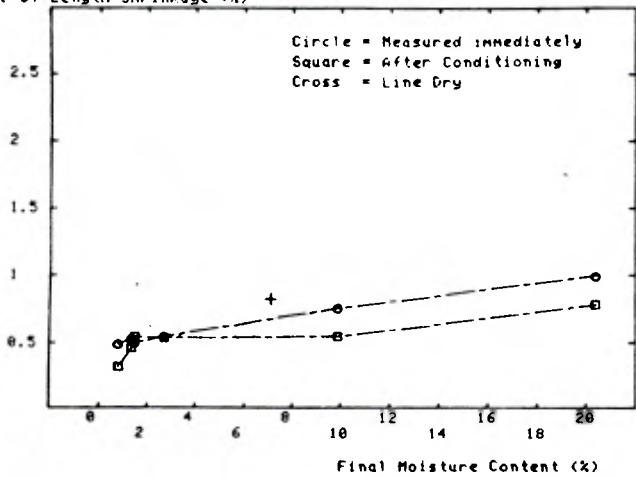
SHRINKAGE IN TUMBLE DRYING : TRIAL 5 : Average of 5 Cycles  
Length Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



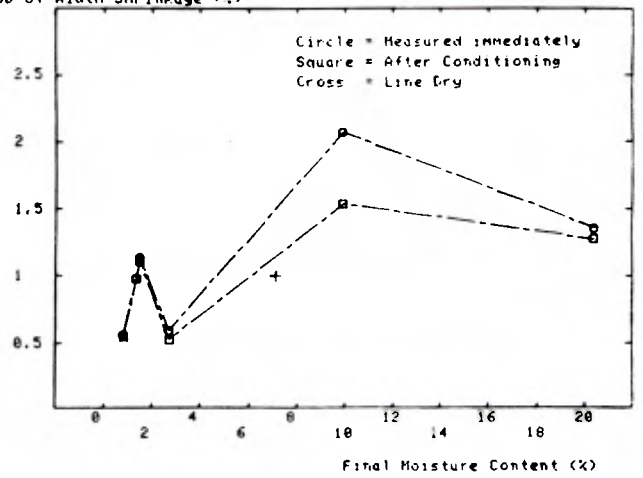
SHRINKAGE IN TUMBLE DRYING : TRIAL 5 : Average of 5 Cycles  
Width Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



SHRINKAGE IN TUMBLE DRYING : TRIAL 5 : Average of 5 Cycles  
SD of Length Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



SHRINKAGE IN TUMBLE DRYING : TRIAL 5 : Average of 5 Cycles  
SD of Width Shrinkage (%) 28g Single Jersey 2/72/287 Gyrostock Dyed



SHRINKAGE IN TUMBLE DRYING : TRIAL 5 : Average of 5 Cycles  
28g Single Jersey 2/72/287 Gyrostock Dyed

