International Institute For Cotton

Technical Research Division

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Research Record No. 151

Project K1/K2 - Single Jersey Fabrics
Effect Of Dyeing & Piece Mercerising On Dimensional Properties, Colour Yield And Economics

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Contents

AW = After Wash, i.e. after IIC Reference Relaxation Procedure

1. Introduction

The objectives of the Kl/K2 projects have already been fully explained in previous reports. This report analyses the following areas.

- The influence, if any, of different types of dyeing machine upon dimensional properties of a range of single jersey fabrics. (Kl/K2 fabrics).
- The influence, if any, of different types of dyeing machine on the colour yield of a range of single jersey fabrics when dyed in the same concentration of dye liquor. (Kl/K2 fabrics).
- The colour yield of identical sets of fabric qualities dyed in different jet dyeing machines in the tubular state and subsequently tubular or open-width finished. (Kl fabrics).
- Comparison of a tubular and open-width mercerised set of single jersey fabrics for
    1. Colour yield
    2. Variation in colour yield across the fabric width (K2 fabrics)
- Quantification of the possible dye savings resulting from piece mercerisation for Procion Blue H-EG.
- Correlation of colour yield from laboratory dyeings reported in *Research Record 141*, and bulk dyeing from Kl/K2.
- Quantification of the economic advantages of piece mercerisation using data obtained during the IIC/TPI exercise and the IIC computer economic model.

2. Influence Of The Dyeing Machine On Dimensional Properties

Details of fabric production for the Kl/K2 trials have been given in *Research Record No. 114*.

To investigate the above objective a limited number of fabric qualities had to be selected. The central yarn counts in both 24 and 28 gauge qualities were chosen for the basis of the K2 project. With singles and equivalent two-fold yarns, each at five stitch lengths, giving a total of twenty construction variants. This was considered to be a minimum number to carry out a useful exercise.

Earlier work (Project CP78) on interlock and rib fabrics suggested that yarn count/stitch length interaction may be influenced by the dyeing process used, particularly if winch and jet machines are compared. There could also be an effect on structure between types of jet machine now in use.

To examine if the dyeing process has an influence on the fully relaxed structure of single jersey fabrics, four dyeing machines available at Meridian were utilised, namely:

Thies R-Jet 95	R95
Scholl Subtilo	SS
Thies RotoStream	RS
Winch	WD

The operations of dyeing and finishing in the tubular form have been fully reported in *Research Record No. 122*. In order to detect the influence of each individual dyeing machine the subsequent finishing route had to be standardised and is briefly described below.

Dyeing Process:	(R-95, SS, RS, or WD)
Calator Airtex:	(De-twist, Hydroextract, Plait)
Pegg Dry	
Heliot calender to width	

Following processing the fabrics were sampled and submitted to the IIC testing department where structural measurements were taken before and after the IIC relaxation procedure.

A comparison has also been made between the four dyeing machines mentioned, where a standard finishing route has been employed, and the remaining unmercerised K2 dye lots where the finishing routes differ. Also included are the identical fabrics from the Kl open-width exercise.

Brazzoli	Tosi, Italy
RotoStream	Engel, Germany
RotoStream OW	Strines, England

2.1. Effect of Dyeing Process on Residual Length and Width Shrinkage (*Tables 1 - 2*)

During the K2 processing at Meridian, no problems were encountered in reaching target widths at each finishing stage. Studying *Tables 1 and 2* it would appear that the winch dyed route gives a slightly more stable fabric compared to the jet machines but not significantly so. The Brazzoli overflow route finished at Tosi also produced similar results compared to the jet machines.

What is clear is that it is much more difficult to stabilise single jersey fabrics by an open-width route even though target widths are attained on the stenter frame and overfeed is used.

2.2. Effect of Dyeing Process on Weight AW (*Table 3*)

No significant difference can be observed between the dye lots finished by an identical tubular finishing route nor by alternative tubular or open-width finishing routes.

2.3. Effect of Dyeing Process on Courses and Wales AW (*Tables 4-5*)

Again, from the dyeing machines or finishing methods examined, no significant difference can be observed.

2.4. Effect of Dyeing Process on Fabric Width AW (*Table 6*)

No influence on fully relaxed width by a particular dyeing machine or finishing route.

2.5. Effect of Dyeing Process on Burst Strength AW (*Table 7*)

The lots dyed in the RotoStream machines at three venues have the lowest mean burst strengths, but these are not significantly lower than the remaining lots. Therefore, no major difference can be observed between jet and winch machines on the influence of the mechanical action of each machine on burst strength.

3. Effect Of Dyeing Process On Colour Yield

To examine the effect of the dyeing process on colour yield, data from six dye lots containing identical fabrics were available. These were the four lots from Meridian plus the two control lots from the mercerising trials at Engel and Tosi.

Thies R-Jet 95	Meridian
Scholl Subtilo	Meridian
Thies RotoStream	Meridian
Winch	Meridian
Brazzoli Overflow	Tosi
Thies RotoStream	Engel

Each dyelot was dyed in a standard concentration of dye liquor, i.e. 2% o.w.f. Procion Blue H-EG with the exception of the Meridian RotoStream batch. This inadvertently received a top-up of dye amounting to a total of 2.3% o.w.f. dyestuff.

Colour reflectance measurements on each fabric quality from each dye lot were made on an ICS Colour Difference Meter; the red, green, blue readings being recorded. The green values for each dyeing machine are listed in *Table 8* and the mean CIELAB lightness value "L" is calculated from the mean "G" values.

The graph in *Figure 1* is taken from experimental results in *Research Record No. 141* and has been used to compare the dye utilised in each dyeing machine, which ranges from 1.58% to 2.05% o.w.f. approximately. Had the Meridian RotoStream batch not received a top-up this would certainly have been weaker in shade than the winch lot. Since the Engel RotoStream lot gave the deepest shade, one cannot therefore state that RotoStream dyeing machines give consistently weaker shades compared to other machines.

What is surprising is that there is a 20% difference in dye utilised between the weakest and the deepest shades.

From this limited exercise, it cannot be confirmed whether this range in colour yield is normal batch-to-batch variability. In the next section, a reasonable estimation of the batch-to-batch reproducibility of the Thies R-Jet 95 is made.

Conclusion: From the six dyeing machines examined, a 20% variation in colour yield was observed.

4. The Variation In Colour Yield Of The Kl Fabrics

Research Records Nos. 122 and 132 describe the operations of dyeing and finishing in tubular and open-width form for the K1 fabrics. Briefly: for the tubular finished fabrics, a total of 94 fabric qualities were split into five dye batches and dyed to the same shade in the Thies R-Jet 95 at Meridian. For the open-width, a total of 124 qualities including 30 for a spirality trial were split into six dye batches and dyed under identical conditions in a Thies RotoStream jet dyeing machine at Strines. Unfortunately, as reported in *Research Record 132*, the batch-to-batch shade reproducibility of the RotoStream dyed fabrics was extremely poor. All but the final batch were considerably weaker in shade than the corresponding R-Jet 95 dyed set. After investigations, no satisfactory explanation for this could be found and so it

is unfortunate that a true comparison of the two dyeing machines for colour yield and reproducibility cannot be made.

However, *Tables 9 - 15* list the reflectance values for both the R-Jet 95 and RotoStream dyed fabrics. It can be seen from *Table 14* that the confidence limits and % Accuracy figures indicate that the shade reproducibility of the R-Jet 95 dyed set is extremely good. If we assume that batch 6 of the RotoStream dyed fabrics is a typical result for this machine using this dyestuff, and if the mean "L" values for both machines are plotted in *Figure 2*, there is a 19% difference in shade between the two machines.

Conclusion: The Thies R-Jet 95 gives good colour yield and batch-to-batch reproducibility.

5. Comparison Of The Tubular And Open-Width Mercerised K2 Fabrics For Colour Yield And Variations In Colour Yield Across Fabric Width

Research Records Nos. 133 and 139 cover the processing details of the tubular and open-width mercerised K2 fabrics together with the corresponding controls.

5.1. Colour Yield

It had been previously estimated that the savings in dyestuff as a result of pre-mercerisation for a 2% shade would be in the order of 25%. In order to achieve a similar depth of shade to the corresponding controls and the rest of the Kl/K2 fabrics, both the tubular mercerised fabrics at Tosi, and the open-width mercerised fabrics at Engel were dyed to a 1.5% shade as opposed to the standard 2% concentration.

The tubular mercerised and control fabrics were dyed in a Brazzoli Overflow dyeing machine at Tosi, and the open-width mercerised and controls on a Thies RotoStream at Engel. *Table 16* lists the colour reflectance measurements for the mercerised fabrics. It can be seen that the mean "L" values for the two sets are identical and this would indicate that there is no difference in the degree of mercerisation for the two systems.

Conclusion: The colour yields of two sets of mercerised K2 fabrics are comparable, thus the Kleinewefers open-width *Centrifuga* merceriser and the Omez *Mercelux* tubular merceriser gave similar degrees of mercerisation.

5.2. Variation in Colour Yield Across Fabric Width

There has been some recent concern about the visual variation in colour depth from edge to middle on some open-width mercerised and dyed fabrics. This has been attributed to the permanent variation in wale spacing across the width of the fabric, caused by uneven tensions as the fabric passes through the merceriser. Visual examination of Lot 10 fabrics mercerised on a Kleinewefers merceriser proves that this set also displays the fault.

To establish, for this set of fabrics, if this variation is purely an optical effect due to wale density, or whether there are differences in the degree of mercerisation, and subsequently differences in dye uptake, colour reflectance measurements were taken across the width of tubular and open-width mercerised and control fabrics after the relaxation procedure.

Tables 17 - 20 list the measurements for all the fabrics, together with means. Studying the red, green, blue mean values in *Table 20* for the open-width mercerised set, it is clear that there is no difference in dye uptake across fabric width compared to the controls or Omez mercerised set.

Conclusion: From this exercise it appears that the visual variation in colour depth across the width of the open-width Kleinewefers mercerised fabric is an optical effect caused by varying wale density.

6. Correlation Of Laboratory And Bulk Dyed Knitgoods For Colour Yield

Research Record No. 141 describes the laboratory examination of the effect of the piece mercerisation of cotton knitgoods on the exhaustion of four reactive dyes, including Procion Blue H-EG. This work gives a good indication of the savings in dyestuff which are possible, and so it is useful to try and make some correlation between the colour yield of laboratory-dyed, mercerised and control fabrics and bulk-dyed, mercerised fabrics and their corresponding controls.

The mean "L" value for the K2 mercerised dye batches is 39.06 for 1.5% o.w.f. dye and that of all the unmercerised dye batches (Kl/K2), excluding the suspect batches dyed at Strines, is 40.19 for 2% o.w.f. dye. These values are plotted on a graph taken from experimental results in *Research Record 141*, shown in *Figure 3*.

They correspond approximately to 1.3% dye and 1.8% dye for the laboratory-dyed samples. For Procion Blue H-EG, it would appear that the laboratory-dyed samples gave an approximately 10% deeper shade than the bulk-dyed fabrics in the Kl/K2 project.

7. Dye Savings Resulting From Piece Mercerisation For Procion Blue H-EG

With regard to dye savings as a consequence of piece mercerisation, it would appear that the 25% reduction in dye concentration for the K2 mercerised lots was an under-estimation. From *Figure 3*, the average shade of the mercerised fabrics is deeper and approximately 11% less dyestuff could have been used to give a shade equivalent to that of the unmercerised fabrics. In other words a 1.34% dye concentration corresponds to a 2% dye concentration on the unmercerised fabric.

The dye saving at this depth of shade for Procion Blue H-EG on the K2 fabrics was therefore approximately 33%. This confirms the figures from the experimental work carried out on this dyestuff in *Research Record No. 141*.

Conclusions:

1. For Procion Blue H-EG laboratory sample dyeings gave 10% deeper shades compared to bulk dyeing for equivalent concentrations of dyestuff on both mercerised and unmercerised knitgoods. This can be taken into consideration during future experimental work.
2. For medium shades of approximately 2% Procion Blue H-EG, a 30-33% saving in dye can be made by pre-mercerisation.

8. Estimation Of The Economic Advantages Of Knitgoods Piece Mercerisation Utilising A Computer Model

Research Record No. 127 outlines the development of a computer programme to enable a realistic picture to be made of the economic consequences of installing knitgoods mercerisers. During the course of the IIC/TPI projects, information on reactive dyestuff savings resulting

from pre-mercerisation has been gathered from IIC experimental work and bulk trials plus data received from dyestuff companies. Therefore, a further exercise can be made utilising the computer model and incorporating these data.

Studying the data available it is clear that, when reactive dyestuffs are used there is always a saving as a result of mercerisation regardless of depth of shade. This percentage saving varies from dyestuff to dyestuff and so in order to analyse the overall benefits for a realistic mill situation, a mean value had to be used. We know from pale to deep shades, savings of 25% - 75% are possible. The computer model has provision for accepting the mean savings at three shade levels, namely, pale, medium, and deep shades. So, for all the data received to date, the following mean dyestuff savings have been calculated.

Pale shades, 0.5 - 1.5% o.w.f.	25% saving
Medium shades, 1.5 - 4.0%	40% "
Deep shades, 4.0 - 8.0%	60% "

To carry out a realistic estimation of the economic consequences of mercerisation, certain assumptions have been made.

A mill, whatever its size, considering the installation of a merceriser, must have enough production available to fully utilise the machine and labour force for at least one shift. A lower-priced tubular merceriser, capable of less hourly production than the larger machines, would be more attractive to a mill mercerising a relatively small annual production of knitgoods.

In this report, a comparison is made between two tubular mercerisers, both being utilised fully for one shift each day. The object of the exercise is to show how a merceriser running under certain circumstances influences the total processing cost per kilogram of fabric, and also the annual overall production costs for the mill. *Figures 4 - 33* are printouts from the economic model which are explained below.

1. Figures 4 - 8 — Small mill, small merceriser during depreciation
2. Figures 9 - 11 — Small mill, small merceriser, no depreciation
3. Figures 12 - 15 — Case (1) + caustic recovery
4. Figures 16 - 18 — Case (2) + caustic recovery
5. Figures 19 - 23 — Large mill, large merceriser during depreciation
6. Figures 24 - 26 — Large mill, large merceriser, no depreciation
7. Figures 27 - 30 — Case (5) + caustic recovery
8. Figures 31 - 33 — Case (6) + caustic recovery

The graphs in *Figures 8, 11, 15, 18, 23, 26, 30 and 33* predict how the cost of processing mercerised fabric changes as the demand upon the merceriser stretches beyond a single shift situation. At a certain percentage production the graph indicates the break-even point of the process, i.e. where the slope crosses the horizontal line *'c'*. The lowest point of each slope indicates the maximum capacity of the merceriser running at the speed inserted into the computer. Line *'m'* is an arbitrary 20% mark up over the unmercerised process cost for the mercerised fabric, to give some indication of profit margin as the merceriser utilisation is increased.

Conclusions

The resultant costs for the above categories are summarised in *Table 21*. The figures listed are the actual costs incurred prior to any mark-up placed on the fabric to reflect any improvement in quality. Certain conclusions have therefore been drawn from this table.

1. Assuming the input figures for percentage dyestuff savings are realistic, during the depreciation period the total processing cost of the mercerised fabric is only fractionally more than the unmercerised fabric.
2. In some countries, legislation makes caustic recovery essential in order to minimise effluent. Whatever the circumstances it would appear that during the depreciation period, a caustic recovery plant pays for itself.
3. Beyond the depreciation period it is clear that mercerisation plus caustic recovery pays for itself. Depending upon the specific circumstances, this process can result in a considerable saving in the total annual production costs of the mill, quite apart from any profits gained from mark-ups for improvements in fabric quality.

Table 1

EFFECT OF DYEING PROCESS ON LENGTH SHRINKAGE

SAMPLE		%Shr.L R-95	%Shr.L RS	%Shr.L SS	%Shr.L WD	%Shr.L Brazz	%Shr.L RS-E	%Shr.L RS-OW
24/1-28/291/		11.7	12.5	12.6	11.8	12.9	15.6	13.9
24/1-28/306/		12.2	14.8	14.2	11.8	13.4	17.3	13.8
24/1-28/321/		15.8	15.5	15.7	14.0	15.8	18.1	18.2
24/1-28/337/		18.5	16.4	17.3	14.2	16.1	18.2	19.1
24/1-28/354/		18.6	17.6	17.6	14.0	19.7	19.9	20.5
	$\bar{x}$	15.4	15.5	15.5	13.2	15.6	17.8	17.1
24/2-56/291/		8.7	11.1	11.9	9.7	9.6	11.9	10.9
24/2-56/306/		12.3	12.7	12.7	12.3	11.3	11.2	12.2
24/2-56/321/		15.3	14.4	13.6	11.7	14.5	11.8	13.0
24/2-56/337/		14.2	15.5	15.7	11.6	14.7	15.0	12.1
24/2-56/354/		16.1	15.0	16.3	14.6	16.4	14.1	10.5
	$\bar{x}$	13.8	13.7	14.0	12.0	13.3	12.8	11.7
28/1-36/259/		13.5	14.8	13.7	11.8	13.9	17.1	14.4
28/1-36/273/		15.3	16.3	15.4	13.2	14.7	19.6	22.3
28/1-36/287/		15.0	16.8	15.7	14.4	16.8	19.9	17.5
28/1-36/301/		18.3	19.3	17.3	16.7	17.3	19.4	20.2
28/1-36/316/		20.8	20.8	18.7	17.5	18.8	22.3	21.9
	$\bar{x}$	16.6	17.6	16.2	14.7	16.3	19.7	19.3
28/2-72/259/		10.1	12.0	10.7	8.3	11.3	12.2	10.9
28/2-72/273/		11.2	13.3	9.5	11.0	11.6	14.7	11.7
28/2-72/287/		15.1	13.7	13.3	12.3	13.5	13.9	13.7
28/2-72/301/		12.1	14.6	13.3	12.0	14.7	14.3	13.4
28/2-72/316/		14.3	16.1	15.1	14.3	15.5	16.1	15.3
	$\bar{x}$	12.6	13.9	12.4	11.6	13.3	14.2	13.0
OVERALL	$\bar{x}$	14.5	15.2	14.5	12.9	14.6	16.1	15.3

Table 2

SINGLE JERSEY PROJECT K2.

EFFECT OF DYEING PROCESS ON WIDTH SHRINKAGE.

SAMPLE		%Shr.W R-95	%Shr.W RS	%Shr.W SS	%Shr.W WD	%Shr.W Brazz	%Shr.W RS-E	%Shr.W RS-OW
24/1-28/291/		11.7	10.2	9.9	12.1	9.9	15.9	15.6
24/1-28/306/		10.3	9.8	9.8	10.3	11.1	19.0	12.1
24/1-28/321/		11.6	8.3	9.2	8.5	10.7	14.4	12.1
24/1-28/337/		10.6	7.4	9.0	9.3	9.9	15.7	12.7
24/1-28/354/		8.7	6.6	6.6	5.0	6.0	13.0	9.8
	$\bar{x}$	10.6	8.5	8.9	9.0	9.5	15.6	12.5
24/2-56/291/		10.3	10.9	11.1	11.7	13.4	14.9	15.0
24/2-56/306/		13.4	10.7	12.2	13.1	12.3	19.3	17.4
24/2-56/321/		12.0	10.1	10.7	11.2	11.6	15.4	12.9
24/2-56/337/		14.0	8.7	10.1	10.2	12.8	16.6	14.0
24/2-56/354/		12.1	10.5	11.6	11.6	13.4	17.6	18.1
	$\bar{x}$	12.4	10.2	11.1	11.6	12.7	16.8	15.5
28/1-36/259/		10.0	8.7	8.3	11.8	9.0	17.1	7.8
28/1-36/273/		11.9	8.7	9.1	9.6	10.4	12.9	12.4
28/1-36/287/		12.8	8.4	9.9	10.9	10.0	10.5	9.8
28/1-36/301/		12.3	6.3	9.3	9.6	6.7	14.0	10.9
28/1-36/316/		8.8	5.9	8.7	10.0	7.4	10.4	9.5
	$\bar{x}$	11.2	7.6	9.1	10.4	8.7	13.0	10.1
28/2-72/259/		13.3	12.2	10.9	13.1	13.3	18.1	15.4
28/2-72/273/		12.6	10.8	10.9	13.3	13.2	14.6	13.8
28/2-72/287/		13.9	11.3	13.2	12.4	13.7	20.0	16.9
28/2-72/301/		15.5	12.1	13.5	12.9	13.3	18.5	16.7
28/2-72/316/		15.7	10.4	14.2	11.8	14.3	14.7	15.4
	$\bar{x}$	14.2	11.3	12.5	12.7	13.6	17.2	15.6
OVERALL	$\bar{x}$	12.1	9.4	10.4	10.9	11.1	15.1	13.4

Table 3

EFFECT OF DYEING PROCESS ON MEAN WEIGHT A/W

SAMPLE		MnWtAW R-95	MnWtAW RS	MnWtAW SS	MnWtAW WD	MnWtAW Brazz	MnWtAW RS-E	MnWtAW RS-OW
24/1-28/291/		160.7	158.1	155.2	158.8	156.4	157.8	159.5
24/1-28/306/		150.7	152.4	144.8	147.0	149.4	152.9	154.5
24/1-28/321/		147.1	144.5	138.3	138.5	141.7	145.8	151.2
24/1-28/337/		142.3	143.2	140.0	138.5	136.1	139.5	134.5
24/1-28/354/		129.2	133.6	134.5	132.5	130.2	135.5	132.0
	$\bar{x}$	146	146	143	143	143	146	146
24/2-56/291/		156.8	152.8	152.3	150.7	151.1	154.2	153.6
24/2-56/306/		146.8	152.1	145.0	147.9	145.4	147.0	146.9
24/2-56/321/		135.5	140.8	134.6	136.1	137.6	140.5	142.5
24/2-56/337/		129.0	128.6	128.0	132.2	126.6	136.3	129.3
24/2-56/354/		119.1	126.6	122.3	122.3	119.8	123.8	122.3
	$\bar{x}$	137	140	136	138	136	140	139
28/1-36/259/		133.0	134.0	131.5	134.5	133.3	137.5	128.6
28/1-36/273/		129.4	129.8	125.7	130.1	129.0	131.0	123.9
28/1-36/287/		122.7	126.7	119.9	123.7	120.8	124.7	119.4
28/1-36/301/		118.0	117.4	117.1	117.1	117.7	118.7	120.3
28/1-36/316/		115.1	112.6	117.5	112.9	113.0	111.7	117.7
	$\bar{x}$	124	124	122	124	123	125	122
28/2-72/259/		135.0	133.1	131.9	134.2	133.4	135.2	138.5
28/2-72/273/		134.8	126.7	123.4	129.1	123.1	128.8	124.5
28/2-72/287/		117.7	120.4	118.9	120.5	115.9	123.1	123.7
28/2-72/301/		109.6	110.8	113.2	114.2	108.3	116.4	111.3
28/2-72/316/		106.5	109.4	107.8	107.8	104.7	111.8	106.3
	$\bar{x}$	121	120	119	121	117	123	121
OVERALL	$\bar{x}$	132	133	130	131	130	134	132

Table 4

EFFECT OF DYEING PROCESS ON COURSES A/W

SAMPLE		C/3cmA R-95	C/3cmA RS	C/3cmA SS	C/3cmA WD	C/3cmA Brazz	C/3cmA RS-E	C/3cmA RS-OW
24/1-28/291/		58.5	58.5	58.6	57.3	57.4	58.2	58.3
24/1-28/306/		54.8	55.6	55.7	53.1	54.0	53.7	54.7
24/1-28/321/		52.6	50.4	52.2	49.9	51.6	50.3	52.0
24/1-28/337/		49.1	49.0	49.2	47.6	48.6	48.9	48.1
24/1-28/354/		45.5	45.8	46.4	44.7	45.5	45.0	44.9
	$\bar{x}$	52.1	51.9	52.4	50.5	51.4	51.2	51.6
24/2-56/291/		56.6	57.2	58.1	55.9	56.8	57.3	54.8
24/2-56/306/		53.3	55.1	53.6	53.0	53.3	51.8	52.3
24/2-56/321/		50.3	50.3	49.7	49.4	50.1	49.0	50.8
24/2-56/337/		46.7	47.5	47.5	46.7	47.2	47.6	47.1
24/2-56/354/		44.4	45.7	44.8	43.5	44.0	45.3	44.7
	$\bar{x}$	50.3	51.2	50.7	49.7	50.3	50.2	49.9
28/1-36/259/		63.5	62.7	65.5	63.2	63.1	64.2	62.2
28/1-36/273/		60.2	60.7	60.7	59.1	58.6	60.3	59.0
28/1-36/287/		54.6	58.1	58.0	56.1	56.4	56.1	54.1
28/1-36/301/		52.0	53.1	53.9	52.0	53.4	51.6	54.8
28/1-36/316/		50.6	49.2	49.7	48.5	49.9	49.0	50.9
	$\bar{x}$	56.2	56.8	57.6	55.8	56.3	56.2	56.2
28/2-72/259/		63.9	61.9	64.1	62.6	62.3	62.4	63.5
28/2-72/273/		57.9	60.0	59.1	58.7	58.5	59.7	58.0
28/2-72/287/		55.6	54.0	55.1	53.7	54.9	53.9	55.2
28/2-72/301/		51.7	50.2	52.1	51.8	51.9	51.1	51.8
28/2-72/316/		48.4	49.6	48.6	48.5	48.4	47.6	50.1
	$\bar{x}$	55.5	55.1	55.1	55.1	55.2	54.9	55.7
OVERALL	$\bar{x}$	53.5	53.8	54.0	52.8	53.3	53.1	53.4

Table 5

EFFECT OF DYEING PROCESS ON WALES A/W

SAMPLE		W/3cmA R-95	W/3cmA RS	W/3cmA SS	W/3cmA WD	W/3cmA Brazz	W/3cmA RS-E	W/3cmA RS-OW
24/1-28/291/		43.6	42.0	42.3	43.3	43.4	42.8	43.3
24/1-28/306/		40.8	41.1	40.5	41.4	41.7	42.1	41.5
24/1-28/321/		40.1	38.3	38.9	38.9	40.2	40.0	40.6
24/1-28/337/		38.4	37.5	39.4	38.7	39.7	38.8	38.9
24/1-28/354/		37.8	37.5	37.4	37.9	38.1	37.7	38.0
	$\bar{x}$	40.1	39.3	39.7	40.0	40.6	40.3	40.5
24/2-56/291/		42.0	41.3	41.6	42.2	42.3	42.6	41.6
24/2-56/306/		40.4	39.8	41.2	40.6	40.9	42.0	41.6
24/2-56/321/		39.1	39.1	38.7	38.8	39.5	40.3	38.8
24/2-56/337/		38.4	36.0	37.5	37.4	37.4	37.8	37.3
24/2-56/354/		35.2	36.4	35.8	36.1	35.7	35.7	36.7
	$\bar{x}$	39.0	38.5	39.0	39.0	39.2	39.7	39.2
28/1-36/259/		48.7	48.7	48.1	48.3	48.8	48.6	49.2
28/1-36/273/		48.2	46.0	46.8	46.7	47.8	46.6	47.0
28/1-36/287/		45.9	45.2	44.8	45.9	46.4	45.9	44.6
28/1-36/301/		45.9	43.7	43.2	44.3	44.6	44.8	44.1
28/1-36/316/		44.2	42.8	44.5	43.4	43.4	43.5	43.5
	$\bar{x}$	46.6	45.3	45.5	45.7	46.2	45.9	45.7
28/2-72/259/		48.5	47.2	47.9	48.1	49.0	48.9	47.5
28/2-72/273/		47.5	45.4	46.1	46.6	46.8	46.4	45.7
28/2-72/287/		43.9	43.4	44.5	43.8	44.1	45.7	45.7
28/2-72/301/		42.8	41.2	42.6	42.2	42.9	42.9	42.1
28/2-72/316/		41.9	39.5	41.5	41.1	41.3	42.7	40.9
	$\bar{x}$	44.9	43.3	44.5	44.4	44.8	45.3	44.4
OVERALL	$\bar{x}$	42.7	41.6	42.2	42.3	42.7	42.8	42.5

Table 6

EFFECT OF DYEING PROCESS ON WIDTH A/W

SAMPLE		WidAW R-95	WidAW RS	WidAW SS	WidAW WD	WidAW Brazz	WidAW RS-E	WidAW RS-OW
24/1-28/291/		66.1	68.6	68.1	66.5	66.4	67.3	66.5
24/1-28/306/		70.6	70.1	71.1	69.6	69.1	68.4	69.4
24/1-28/321/		71.8	75.2	74.0	74.0	71.6	72.0	70.9
24/1-28/337/		75.0	76.8	73.1	74.4	72.5	74.2	74.0
24/1-28/354/		76.2	76.8	77.0	76.0	75.6	76.4	75.8
	$\bar{x}$	71.9	73.5	72.7	72.1	71.0	71.7	71.3
24/2-56/291/		68.6	69.7	69.2	68.2	68.1	67.6	69.2
24/2-56/306/		71.3	72.4	69.9	70.9	70.4	68.6	69.2
24/2-56/321/		73.7	73.7	74.4	74.2	72.9	71.5	74.2
24/2-56/337/		75.0	80.0	76.8	77.0	77.0	76.2	77.2
24/2-56/354/		81.8	79.1	80.4	79.8	80.7	80.7	78.5
	$\bar{x}$	74.1	75.0	74.1	74.0	73.8	72.9	73.7
28/1-36/259/		65.1	65.1	65.9	65.6	64.9	65.2	64.4
28/1-36/273/		65.7	68.9	67.7	67.8	66.3	68.0	67.4
28/1-36/287/		69.0	70.1	70.7	69.0	68.3	69.0	71.0
28/1-36/301/		69.0	72.5	73.3	71.5	71.0	70.7	71.8
28/1-36/316/		71.7	74.0	71.2	73.0	73.0	72.8	72.8
	$\bar{x}$	68.1	70.1	69.8	69.4	68.8	69.1	69.5
28/2-72/259/		65.3	67.1	66.1	65.9	64.7	64.8	66.7
28/2-72/273/		66.7	69.8	68.7	68.0	67.7	68.3	69.3
28/2-72/287/		72.2	73.0	71.2	72.3	71.8	69.3	69.3
28/2-72/301/		74.0	76.9	74.4	75.1	73.8	73.8	75.2
28/2-72/316/		75.6	80.2	76.3	77.1	76.7	74.2	77.5
	$\bar{x}$	70.8	73.4	71.3	71.7	70.9	70.1	71.6
OVERALL	$\bar{x}$	71.2	73.0	72.0	71.8	71.1	71.0	71.5

Table 7

EFFECT OF DYEING PROCESS ON BURST STRENGTH A/W

SAMPLE		Bst.AW R-95	Bst.AW RS	Bst.AW SS	Bst.AW WD	Bst.AW Brazz	Bst.AW RS-E	Bst.AW RS-OW
24/1-28/291/		525.2	509.0	528.2	517.0	535.8	506.0	526.8
24/1-28/306/		502.2	476.8	513.3	498.3	519.8	493.5	521.7
24/1-28/321/		443.7	476.7	482.8	492.3	511.1	454.2	497.3
24/1-28/337/		434.3	460.4	448.8	470.0	462.8	427.5	472.7
24/1-28/354/		436.0	423.1	461.2	443.6	443.4	410.3	395.3
	$\bar{x}$	468.3	469.2	486.9	484.2	494.6	458.3	482.8
24/2-56/291/		737.0	685.0	689.8	696.2	718.9	671.9	702.7
24/2-56/306/		643.0	676.9	685.4	676.3	703.2	631.4	661.2
24/2-56/321/		657.3	623.6	662.4	656.8	650.4	588.0	634.1
24/2-56/337/		641.1	599.5	627.9	603.6	620.8	604.2	592.4
24/2-56/354/		609.9	583.5	628.2	616.0	606.4	578.8	572.6
	$\bar{x}$	657.7	633.7	658.7	649.8	660	614.9	632.6
28/1-36/259/		443.2	420.2	441.3	449.6	471.0	438.5	438.4
28/1-36/273/		413.9	397.1	430.9	436.0	429.8	414.8	447.8
28/1-36/287/		394.9	378.2	381.5	425.3	420.2	372.0	398.1
28/1-36/301/		378.6	377.3	369.6	377.6	384.0	369.3	376.6
28/1-36/316/		354.9	343.6	368.5	365.7	374.2	379.0	363.9
	$\bar{x}$	397	383.3	398.4	410.8	415.8	394.7	405
28/2-72/259/		601.4	581.4	575.9	583.8	631.9	580.3	579.6
28/2-72/273/		614.2	557.6	571.7	577.6	611.2	557.4	611.5
28/2-72/287/		554.0	526.6	545.8	550.4	572.1	547.3	554.0
28/2-72/301/		559.1	508.9	540.8	534.6	546.8	515.2	517.0
28/2-72/316/		521.7	487.5	528.5	504.6	513.8	493.0	490.2
	$\bar{x}$	570.1	532.4	552.5	550.6	575.2	538.6	550.5
OVERALL	$\bar{x}$	523.3	504.7	524.1	523.9	536.4	501.6	517.8

Table 8

EFFECT OF DYEING PROCESS ON COLOUR YIELD, GREEN REFLECTANCE

SAMPLE		"G" R-95	"G" RS	"G" SS	"G" WD	"G" Brazz	"G" RS-E
24/1-28/291/		10.4	11.3	11.9	12.2	11.4	10.6
24/1-28/306/		10.0	10.9	11.8	11.5	11.5	9.5
24/1-28/321/		10.6	11.4	10.7	11.6	11.1	9.7
24/1-28/337/		10.0	11.5	11.2	11.6	11.3	9.6
24/1-28/354/		10.1	11.0	11.2	11.5	11.1	9.9
24/2-56/291/		11.5	12.1	12.8	13.2	12.2	11.2
24/2-56/306/		11.4	11.9	12.4	12.7	12.3	10.5
24/2-56/321/		10.7	12.3	12.6	12.6	11.8	11.0
24/2-56/337/		11.8	12.2	12.4	12.4	12.0	10.6
24/2-56/354/		11.7	11.5	11.9	11.9	11.4	10.4
28/1-36/259/		10.7	11.3	11.7	11.9	11.5	10.2
28/1-36/273/		10.0	10.7	11.6	11.4	11.3	10.5
28/1-36/287/		9.4	11.1	11.4	11.6	11.1	10.4
28/1-36/301/		10.0	10.9	11.3	11.5	10.6	9.6
28/1-36/316/		9.5	11.4	11.2	11.2	10.6	9.5
28/2-72/259/		11.5	12.1	12.9	12.6	12.0	10.8
28/2-72/273/		11.1	11.5	12.8	12.6	11.8	11.3
28/2-72/287/		11.4	11.8	12.4	12.8	11.7	10.5
28/2-72/301/		11.8	11.9	12.1	12.4	11.6	10.5
28/2-72/316/		11.5	11.9	11.9	11.9	11.3	10.6
	$\bar{x}$	10.8	11.54	11.9	12.1	11.5	10.35
MEAN 'L'		39.25	40.48	41.06	41.38	40.42	38.47

Table 9

TUBULARvOW COLOUR YIELD

SAMPLE	"R" R-95	"R" RS-OW	"G" R-95	"G" RS-OW	"B" R-95	"B" RS-OW
18/1-16/344/	5.3	8.7	11.4	16.2	34.7	40.5
18/1-16/362/	4.9	16.2	10.5	25.4	33.1	51.0
18/1-16/380/	4.7	10.5	10.1	18.8	32.2	43.6
18/1-16/399/	5.3	10.8	11.2	19.2	34.3	44.4
18/1-16/419/	5.0	8.8	10.8	16.3	33.0	41.0
18/1-20/327/	5.1	8.7	10.8	16.2	32.9	40.4
18/1-20/344/	5.4	8.7	11.4	16.2	34.7	40.2
18/1-20/362/	5.0	16.2	10.6	26.0	33.1	51.0
18/1-20/380/	4.7	16.1	10.2	25.3	32.3	51.3
18/1-20/399/	4.7	17.1	10.0	26.5	31.7	52.8
18/1-24/311/	5.7	8.8	11.8	16.5	35.1	41.4
18/1-24/327/	5.3	8.7	11.1	16.1	33.8	40.6
18/1-24/344/	5.0	8.6	10.6	16.2	32.3	40.5
18/1-24/362/	5.1	8.6	10.7	15.8	32.8	40.0
18/1-24/380/	4.8	8.6	10.3	15.8	31.6	39.9

Table 10

18 GAUGE SINGLE JERSEY, TWO-FOLD YARNS.

TUBULARvOW COLOUR YIELD

SAMPLE	"R" R-95	"R" RS-OW	"G" R-95	"G" RS-OW	"B" R-95	"B" RS-OW
18/2-32/344/	6.0	9.0	12.3	16.3	35.7	39.8
18/2-32/362/	5.7	17.4	11.8	26.6	35.2	52.0
18/2-32/380/	5.3	11.3	11.2	19.6	33.9	44.2
18/2-32/399/	5.3	11.6	11.2	20.1	33.9	44.9
18/2-32/419/	5.5	9.5	11.7	17.2	33.8	41.7
18/2-40/327/	5.9	9.4	12.2	17.1	35.7	41.3
18/2-40/344/	5.9	9.2	12.2	16.7	35.7	40.8
18/2-40/362/	5.4	17.8	11.3	27.4	34.1	52.8
18/2-40/380/	5.3	10.9	10.9	19.3	32.9	43.7
18/2-40/399/	5.2	11.8	10.7	20.1	32.2	44.5
18/2-48/311/	5.8	9.0	11.9	16.6	34.9	41.0
18/2-48/327/	5.6	9.3	11.6	17.0	33.9	41.8
18/2-48/344/	5.6	8.9	11.5	16.4	34.0	40.7
18/2-48/362/	5.2	16.3	11.0	25.6	33.7	51.9
18/2-48/380/	5.1	10.5	10.5	18.5	32.1	43.5

Table 11

24 GAUGE SINGLE JERSEY, SINGLES YARNS.

TUBULARvOW COLOUR YIELD

SAMPLE	"R" R-95	"R" RS-OW	"G" R-95	"G" RS-OW	"B" R-95	"B" RS-OW
24/1-24/306/	5.3	12.4	10.9	20.9	33.2	46.0
24/1-24/321/	5.3	12.3	11.0	20.9	33.6	46.4
24/1-24/337/	5.0	9.2	10.7	16.8	32.4	41.5
24/1-24/354/	5.6	6.0	11.9	12.2	34.5	35.4
24/1-24/372/	5.0	5.9	10.7	12.1	32.3	35.1
24/1-28/291/	4.8	16.1	10.4	25.3	32.7	51.9
24/1-28/306/	4.7	10.6	10.0	18.8	31.3	44.2
24/1-28/321/	4.9	11.7	10.6	19.9	32.5	44.9
24/1-28/337/	4.8	8.7	10.0	16.2	30.9	41.4
24/1-28/354/	4.6	8.6	10.1	16.0	31.0	40.9
24/1-32A276/	5.3	8.9	11.1	16.3	33.3	40.9
24/1-32A291/	4.8	16.4	10.3	25.8	32.5	52.6
24/1-32A306/	4.5	16.8	9.6	26.4	31.1	53.2
24/1-32A321/	4.5	10.6	9.6	18.8	30.6	44.7
24/1-32A337/	4.8	11.5	10.1	19.8	31.5	46.0
24/1-32/276/	5.0	8.7	10.5	16.0	32.3	40.3
24/1-32/291/	4.8	15.8	10.2	24.9	32.0	51.7
24/1-32/306/	4.7	10.3	9.9	18.5	31.2	44.0

Table 12

24 GAUGE SINGLE JERSEY, TWO-FOLD YARNS.

TUBULARvOW COLOUR YIELD

SAMPLE	"R" R-95	"R" RS-OW	"G" R-95	"G" RS-OW	"B" R-95	"B" RS-OW
24/2-48/306/	5.6	12.3	11.4	20.8	34.0	45.7
24/2-48/321/	5.2	9.6	10.9	17.3	33.0	42.3
24/2-48/337/	5.7	6.3	11.9	12.8	34.2	36.5
24/2-48/354/	5.7	6.3	11.9	12.9	34.5	36.8
24/2-48/372/	5.5	6.0	11.5	12.3	33.7	35.6
24/2-56/291/	5.6	11.2	11.5	19.6	33.9	44.8
24/2-56/306/	5.6	12.4	11.4	20.8	34.1	46.3
24/2-56/321/	5.2	12.5	10.7	21.8	32.8	46.8
24/2-56/337/	5.7	9.1	11.8	16.8	34.2	42.2
24/2-56/354/	5.6	5.9	11.7	12.2	34.1	35.6
24/2-64/276/	5.5	16.8	11.4	26.2	34.1	53.3
24/2-64/291/	5.3	11.0	10.9	19.4	33.1	45.0
24/2-64/306/	5.4	12.0	11.1	20.4	33.6	45.7
24/2-64/321/	5.3	9.1	10.8	16.7	32.8	42.0
24/2-64/337/	5.3	5.9	11.2	12.1	33.3	35.6

Table 13

28 GAUGE SINGLE JERSEY, SINGLES YARNS.

TUBULARvOW COLOUR YIELD

SAMPLE	"R" R-95	"R" RS-OW	"G" R-95	"G" RS-OW	"B" R-95	"B" RS-OW
28/1-32A273/	5.0	10.6	10.4	18.8	32.2	44.3
28/1-32A287/	4.9	11.5	10.2	19.8	31.7	45.4
28/1-32A301/	4.9	8.8	10.2	16.2	31.5	41.1
28/1-32A316/	5.0	8.9	10.7	16.4	32.6	42.0
28/1-32A332/	5.2	5.7	11.0	11.8	33.2	35.2
28/1-36/259/	5.1	9.1	10.7	16.7	33.1	41.5
28/1-36/273/	4.7	16.3	10.0	25.6	31.8	52.7
28/1-36/287/	4.5	10.3	9.4	18.3	30.2	44.0
28/1-36/301/	4.8	11.5	10.0	20.0	31.3	46.1
28/1-36/316/	4.6	11.2	9.5	19.5	30.1	45.6
28/1-40/246/	5.1	8.6	10.7	15.9	32.7	40.5
28/1-40/259/	5.5	8.5	11.3	15.7	33.4	40.2
28/1-40/273/	4.9	16.0	10.4	25.3	32.5	52.7
28/1-40/287/	4.6	15.9	9.9	25.4	31.4	53.4
28/1-40/301/	4.4	10.7	9.4	19.0	30.2	45.6
28/1-32/273/	4.9	10.8	10.2	19.1	32.0	44.8

Table 14

28 GAUGE SINGLE JERSEY, TWO-FOLD YARNS.

TUBULARvOW COLOUR YIELD

SAMPLE	"R" R-95	"R" RS-OW	"G" R-95	"G" RS-OW	"B" R-95	"B" RS-OW
28/2-64/273/	4.8	11.3	10.0	19.8	30.9	45.4
28/2-64/287/	5.0	12.5	10.5	21.1	32.4	46.7
28/2-64/301/	5.1	9.4	10.7	17.1	32.8	42.6
28/2-64/316/	5.6	9.6	11.8	17.4	34.5	42.8
28/2-64/332/	5.5	6.1	11.6	12.4	34.0	36.1
28/2-72/259/	5.6	10.3	11.5	20.1	34.5	54.0
28/2-72/273/	5.4	11.3	11.1	19.7	33.5	45.7
28/2-72/287/	5.6	12.5	11.4	21.2	34.1	47.4
28/2-72/301/	5.7	9.4	11.8	17.1	34.5	43.4
28/2-72/316/	5.4	5.9	11.5	12.1	34.1	35.9
28/2-80/246/	5.5	9.3	11.4	17.0	34.2	42.3
28/2-80/259/	5.2	16.8	10.9	26.3	33.3	53.6
28/2-80/273/	5.1	11.1	10.6	19.6	32.6	46.3
28/2-80/287/	5.5	12.1	11.2	20.8	33.6	47.4
28/2-80/301/	5.4	8.9	11.3	16.6	33.7	42.6

94 SAMPLES

$\bar{x}$	10.88
C.L	.14
2A	1.29
Mean 'L' value	39.39

Table 15

SINGLE JERSEY SPIRALITY TRIAL

TUBULARvOPEN WIDTH .....remaining OW samples.

SAMPLE	"R" RS-OW	"G" RS-OW	"B" RS-OW	SAMPLE	"R" RS-OW	"G" RS-OW	"B" RS-OW
18/1-20X327/	9.8	16.7	41.1	24/1-28X291/	9.8	16.4	41.2
18/1-20X344/	16.8	24.9	50.1	24/1-28X306/	5.7	11.9	34.7
18/1-20X362/	10.4	18.5	43.2	24/1-28X321/	5.7	11.6	34.1
18/1-20X380/	11.7	20.0	45.1	24/1-28X337/	5.6	11.5	34.0
18/1-20X399/	8.6	15.8	39.7	24/1-28X354/	5.2	11.0	32.5
28/1-36X259/	8.8	16.0	40.5	24/1-28S291/	18.0	27.7	53.8
28/1-36X273/	5.9	11.9	34.8	24/1-28S306/	12.1	20.6	46.0
28/1-36X287/	5.6	11.5	34.4	24/1-28S321/	12.1	20.6	46.1
28/1-36X301/	5.7	11.6	34.4	24/1-28S337/	11.8	20.2	45.6
28/1-36X316/	5.6	11.5	34.2	24/1-28S354/	5.8	11.9	34.7
				24/1-28L291/	10.8	19.1	44.6
				24/1-28L306/	11.9	20.3	45.8
				24/1-28L321/	8.8	16.3	41.3
				24/1-28L337/	8.8	16.3	41.1
				24/1-28L354/	8.8	16.3	41.5
				24/1-28H291/	16.2	25.4	51.6
				24/1-28H306/	16.3	25.4	51.7
				24/1-28H321/	10.3	18.4	43.8
				24/1-28H337/	11.1	19.2	44.2
				24/1-28H354/	8.5	15.7	39.8
				124 Samples	$\bar{x}$	18.7	
					95% C.L.	0.72	
					%A	3.84	
					Mean 'L' value	50.34	
					Mean 'L' of Last Batch	41.06	

Table 16

SINGLE JERSEY PROJECT K2.

TUBULAR & OW MERCERISATION - MERC'D FABRICS - COLOUR YIELD

SAMPLE	"R" Omez	"R" Kwfrs	"G" Omez	"G" Kwfrs	"B" Omez	"B" Kwfrs
24/1-28/291/	4.5	4.7	10.3	10.4	33.0	30.7
24/1-28/306/	4.6	4.6	10.5	10.2	33.3	30.4
24/1-28/321/	4.5	4.7	10.4	10.4	33.1	30.7
24/1-28/337/	4.4	4.4	10.2	9.9	32.7	30.1
24/1-28/354/	4.4	4.3	10.1	9.7	32.4	29.9
24/2-56/291/	5.3	5.2	11.7	11.2	35.5	31.7
24/2-56/306/	4.8	5.2	10.8	11.1	33.7	31.1
24/2-56/321/	4.9	5.4	10.9	11.3	33.8	31.6
24/2-56/337/	4.7	4.8	10.6	10.4	33.1	30.2
24/2-56/354/	4.7	5.3	10.4	11.1	33.1	31.3
28/1-36/259/	4.9	4.8	10.9	10.5	34.0	31.2
28/1-36/273/	4.7	4.7	10.6	10.5	33.4	31.4
28/1-36/287/	4.3	4.9	10.0	10.6	32.5	31.4
28/1-36/301/	4.6	4.7	10.4	10.2	33.5	30.7
28/1-36/316/	4.6	4.8	10.5	10.4	33.3	31.3
28/2-72/259/	5.3	5.2	11.7	11.1	35.4	31.7
28/2-72/273/	5.1	5.2	11.3	11.2	34.7	32.1
28/2-72/287/	5.1	5.5	11.2	11.4	34.7	32.0
28/2-72/301/	4.7	5.1	10.6	10.9	33.6	31.4
28/2-72/316/	4.8	5.3	10.7	11.1	33.9	32.0
	$\bar{x}$		10.69	10.68		
	Mean L		39.06	39.05		

Table 17

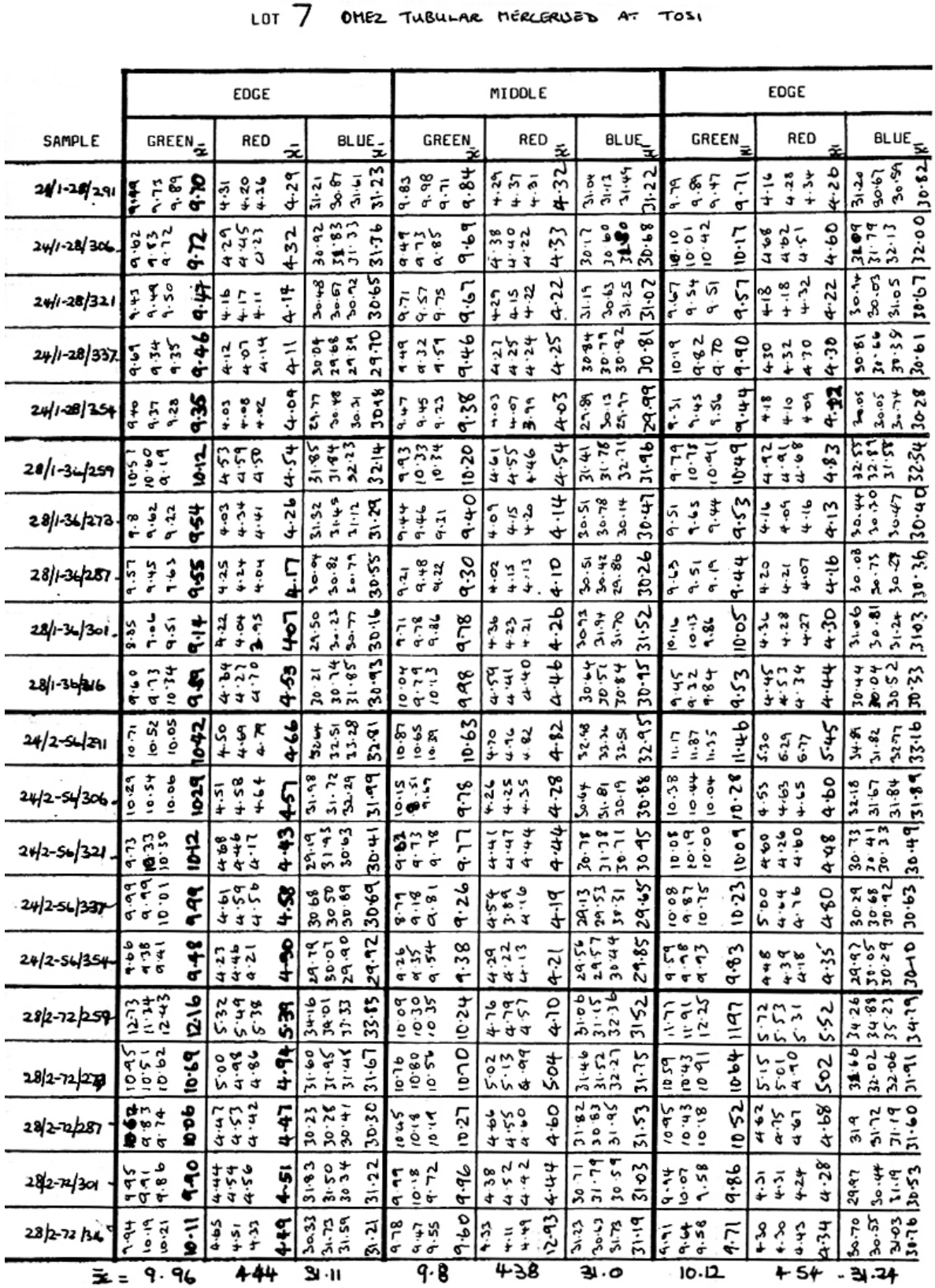

LOT 7 OMEZ TUBULAR MERCERIZED AT TOSI
EDGE
MIDDLE
EDGE
SAMPLE
GREEN
RED
BLUE
24/1-28/291
24/1-28/306
24/1-28/321
24/1-28/337
24/1-28/354
28/1-34/259
28/1-36/278
28/1-36/287
28/1-36/301
28/1-36/316
24/2-54/291
24/2-54/306
24/2-56/321
24/2-56/337
24/2-54/354
28/2-72/259
28/2-72/278
28/2-72/287
28/2-72/301
28/2-72/316

Table 18

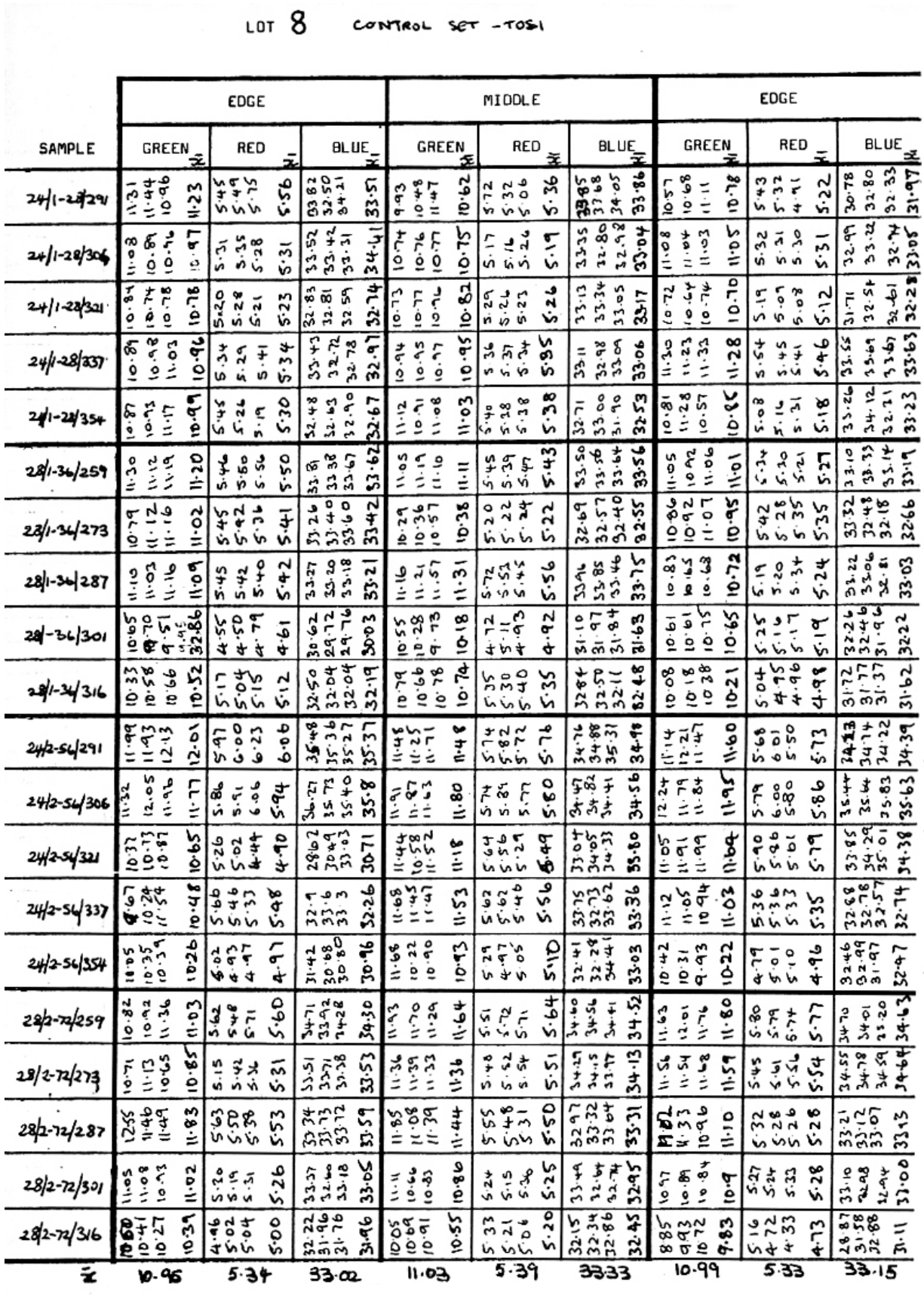

LOT 8 CONTROL SET -TOSI
EDGE
MIDDLE
EDGE
SAMPLE
GREEN
RED
BLUE
GREEN
RED
BLUE
GREEN
RED
BLUE
24/1-28/291
24/1-28/306
24/1-28/321
24/1-28/337
24/1-28/354
28/1-36/259
28/1-36/273
28/1-36/287
28/1-36/301
28/1-36/316
24/2-54/291
24/2-54/306
24/2-54/321
24/2-54/337
24/2-54/354
28/2-72/259
28/2-72/273
28/2-72/287
28/2-72/301
28/2-72/316

Table 19

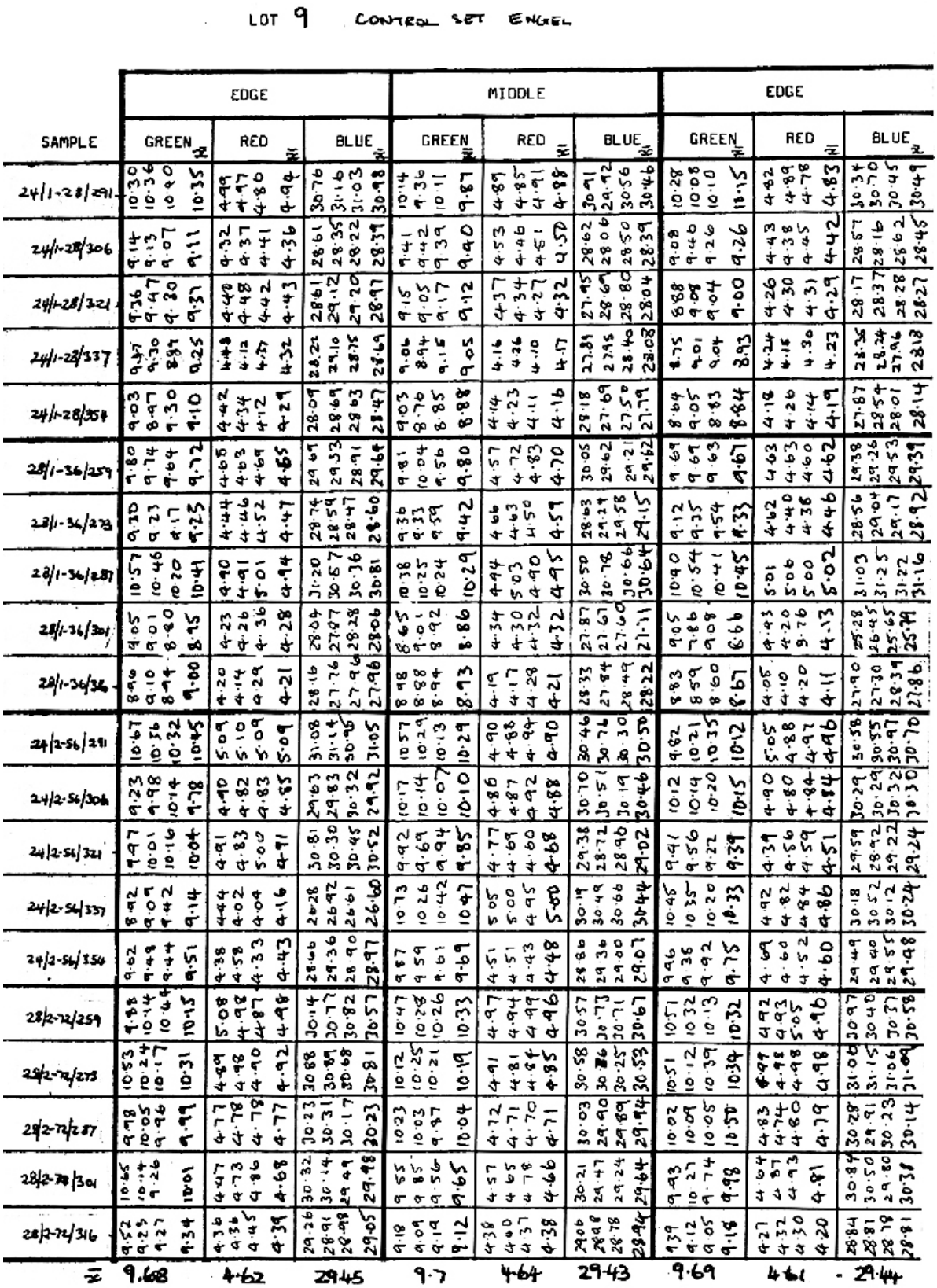

LOT 9 CONTROL SET ENGEL
EDGE
MIDDLE
EDGE
SAMPLE
GREEN
RED
BLUE
GREEN
RED
BLUE
GREEN
RED
BLUE
24/1-28/291
24/1-28/306
24/1-28/321
24/1-28/337
24/1-28/354
28/1-36/259
28/1-36/273
28/1-36/287
28/1-36/301
28/1-36/316
24/2-56/291
24/2-56/306
24/2-56/321
24/2-56/337
24/2-56/354
28/2-72/259
28/2-72/273
28/2-72/287
28/2-72/301
28/2-72/316

Table 20

LOT 10 KLEINEWEFERS O/W MERCERISED AT ENGEL

SAMPLE	EDGE						MIDDLE						EDGE					
	GREEN		RED		BLUE		GREEN		RED		BLUE		GREEN		RED		BLUE	
		MI		MI		MI		MI		MI		MI		MI		MI		MI
24/1-28/291	9·56		4·19		28·3		9·76		4·37		29·2		9·36		4·30		29·68	
	9·42		4·15		28·5		9·67		4·44		28·63		9·55		4·38		28·1	
	9·25	9·41	4·16	4·16	28·92	28·57	9·50	9·64	4·44	4·41	29·2	29·01	9·36	9·42	4·23	4·30	28·43	28·40
24/1-28/306	9·74		4·54		28·46		9·84		4·36		29·73		9·23		4·66		29·98	
	9·75		4·52		29·42		9·78		4·52		29·38		9·13		4·63		30·28	
	9·90	9·76	4·49	4·51	29·42	29·1	9·82	9·81	4·53	4·47	28·67	29·26	10·07	9·67	4·57	4·62	30·05	30·08
24/1-28/321	9·61		4·44		28·89		9·26		4·44		28·28		9·62		4·52		29·86	
	9·44		4·45		28·22		9·75		4·58		29·22		9·57		4·47		29·05	
	9·41	9·48	4·42	4·43	28·50	28·53	9·40	9·49	4·41	4·47	27·87	28·45	9·66	9·61	4·42	4·47	28·86	28·92
24/1-28/337	9·00		4·31		28·83		8·80		4·26		26·34		9·28		4·43		29·16	
	9·23		4·25		28·15		8·85		4·14		27·18		9·68		4·49		29·03	
	9·40	9·21	4·29	4·28	27·51	28·16	9·24	8·96	4·11	4·17	27·05	26·95	9·53	9·49	4·35	4·42	28·22	28·81
24/1-28/354	9·96		3·94		27·55		8·43		3·76		27·02		8·65		4·00		27·76	
	9·91		3·96		27·72		8·50		3·79		27·06		8·88		3·99		27·19	
	9·70	9·85	4·00	3·96	27·58	27·61	8·38	8·43	3·73	3·76	26·91	26·99	8·93	8·78	3·89	3·96	27·78	27·57
28/1-36/259	9·11		4·22		24·66		8·97		3·98		27·33		8·84		3·95		27·43	
	9·12		4·27		28·40		9·03		3·89		27·5		8·94		3·99		27·74	
	9·19	9·14	4·17	4·22	28·16	27·14	8·74	8·91	3·96	3·94	27·67	27·5	8·77	8·85	3·99	3·97	27·88	27·68
28/1-36/273	9·60		4·47		29·94		9·46		4·33		28·53		9·65		4·50		29·62	
	9·45		4·48		29·71		9·45		4·27		28·99		9·63		4·47		29·57	
	9·64	9·56	4·37	4·44	29·16	29·27	9·38	9·42	4·22	4·27	28·97	28·76	9·70	9·66	4·35	4·43	29·33	28·57
28/1-36/287	9·82		4·61		30·18		9·71		4·43		28·95		9·38		4·34		27·62	
	9·96		4·59		29·36		9·59		4·37		29·19		9·11		4·23		27·64	
	9·97	9·86	4·62	4·60	29·36	29·63	9·58	9·62	4·36	4·38	28·93	29·02	9·38	9·29	4·35	4·30	28·56	28·56
28/1-36/301	9·31		4·44		28·86		9·71		4·13		27·74		9·50		4·45		22·52	
	9·54		4·40		28·65		9·67		4·12		27·38		9·33		3·86		27·19	
	9·56	9·47	4·30	4·37	28·42	28·64	9·48	9·79	4·13	4·12	27·11	27·41	9·22	8·01	3·34	3·88	28·00	26·90
28/1-36/316	9·06		3·99		26·74		9·91		4·02		27·74		9·05		3·85		28·49	
	8·99		4·03		27·53		9·83		4·03		27·79		9·04		4·11		27·48	
	8·90	8·91	4·06	4·03	28·11	27·46	8·81	8·81	4·06	4·03	27·45	27·66	8·49	8·86	3·97	3·97	28·00	27·98
24/2-54/291	10·22		4·85		29·47		9·62		4·30		26·16		9·76		4·74		28·32	
	10·11		4·76		28·72		9·83		4·60		28·42		10·28		4·86		29·95	
	10·25	10·19	4·73	4·78	29·41	29·2	9·23	9·56	4·50	4·46	28·07	27·55	9·98	10·00	4·67	4·75	29·26	28·84
24/2-54/306	10·66		4·70		28·97		9·62		4·55		29·14		9·67		4·35		26·52	
	9·97		4·75		28·15		9·65		4·45		28·07		9·75		4·42		27·92	
	9·95	10·19	4·73	4·72	28·66	28·92	9·62	9·63	4·52	4·50	27·68	28·36	9·68	9·7	4·42	4·39	28·37	27·60
24/2-54/321	9·74		4·82		27·99		10·34		4·89		30·45		10·07		4·85		30·12	
	9·92		4·84		27·55		10·34		4·82		30·49		10·29		4·81		29·1	
	10·33	9·99	5·02	4·89	29·00	28·16	10·34	10·34	4·80	4·83	30·05	30·38	9·88	10·08	4·78	4·64	28·71	29·31
24/2-56/337	9·95		4·38		28·43		9·19		4·23		29·32		8·36		4·10		26·64	
	9·35		4·35		27·80		8·89		4·16		27·13		8·64		3·80		26·71	
	9·44	9·58	4·38	4·37	27·73	27·98	9·11	9·06	4·27	4·22	27·93	27·62	8·84	8·61	3·96	3·95	25·63	26·32
24/2-56/354	11·49		5·05		30·98		9·13		4·12		29·09		9·59		4·72		28·28	
	10·61		4·87		29·48		9·00		4·06		28·19		9·85		4·69		27·51	
	10·45	10·85	4·91	4·94	32·04	30·8	8·98	9·63	4·03	4·07	27·82	28·36	9·90	9·78	4·79	4·73	27·67	27·98
28/2-72/299	9·61		4·60		27·86		9·73		4·68		28·25		9·75		4·79		28·02	
	9·67		4·57		28·41		9·75		4·61		28·93		10·09		4·84		30·09	
	9·78	9·68	4·59	4·58	28·34	28·20	9·98	9·76	4·57	4·62	28·60	28·59	10·00	9·94	4·81	4·79	28·37	28·49
28/2-72/278	10·50		5·20		29·62		10·61		5·15		26·84		10·10		5·05		29·78	
	10·64		5·05		30·78		10·63		5·07		30·27		10·55		5·13		29·94	
	10·94	10·66	5·06	5·10	30·04	30·21	10·72	10·65	5·04	5·08	30·41	29·17	10·33	10·52	4·90	5·02	30·51	30·07
28/2-72/287	9·39		4·24		28·62		9·30		4·31		27·45		8·92		4·20		27·78	
	9·66		4·29		28·27		9·40		4·42		27·81		8·91		4·11		27·42	
	9·05	9·36	4·37	4·3	27·92	28·27	9·23	9·31	4·32	4·35	27·79	27·68	9·03	8·95	4·24	4·18	27·13	27·44
28/2-72/301	10·16		5·0		28·61		10·40		4·77		26·92		9·78		4·69		30·08	
	9·62		4·72		29·08		10·22		4·81		28·58		10·25		4·81		29·06	
	10·42	10·06	4·73	4·81	29·44	29·04	9·80	9·96	5·01	4·86	29·47	29·32	9·87	9·96	4·77	4·75	28·56	29·23
28/2-72/316	9·35		4·25		28·23		9·40		4·53		26·67		9·94		4·60		30·08	
	9·29		4·39		27·98		9·19		4·98		27·30		9·68		4·73		29·06	
	9·18	9·27	4·38	4·34	27·95	28·02	9·54	9·37	4·41	4·48	27·88	27·95	9·61	9·81	4·59	4·66	29·38	28·06
	9·67		4·49		28·64		9·44		4·37		28·24		9·45		4·41		28·93	

Table 21

COST UNDER SPECIFIED MILL SITUATIONS	SMALL MERCERISER 1	2	3	4	LARGE MERCERISER 5	6	7	8
Merc. Cost (£/kg)	0.26	0.19	0.26	0.16	0.18	0.11	0.19	0.09
Process cost of merc. fabric(£/kg)	0.93	0.87	0.93	0.84	0.71	0.65	0.72	0.62
Process cost of fabric with no merceriser (£/kg)	0.84	0.84	0.84	0.84	0.69	0.69	0.69	0.69
Net merc. cost (£/kg)	0.09	0.02	0.09	-0.01	0.02	0.05	0.02	0.08
Net annual additional cost of including a merc. process (£)	25011	6555	24767	-1361	12619	-35381	16462	-55996

Costs taken from computer economic model

Figure 1

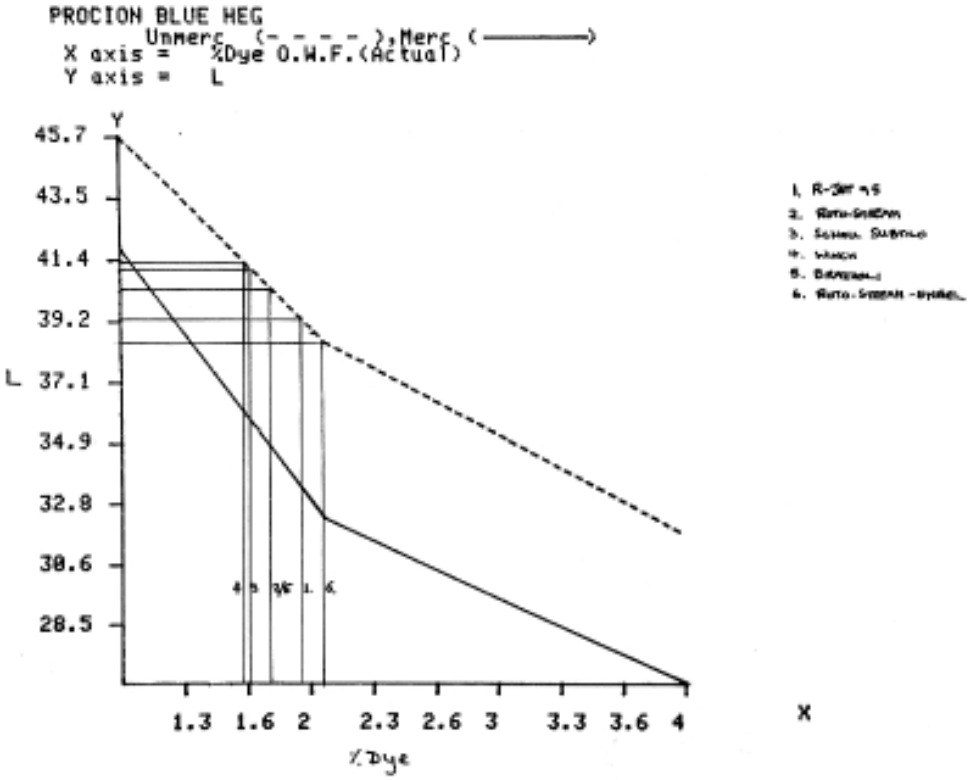


Figure 2

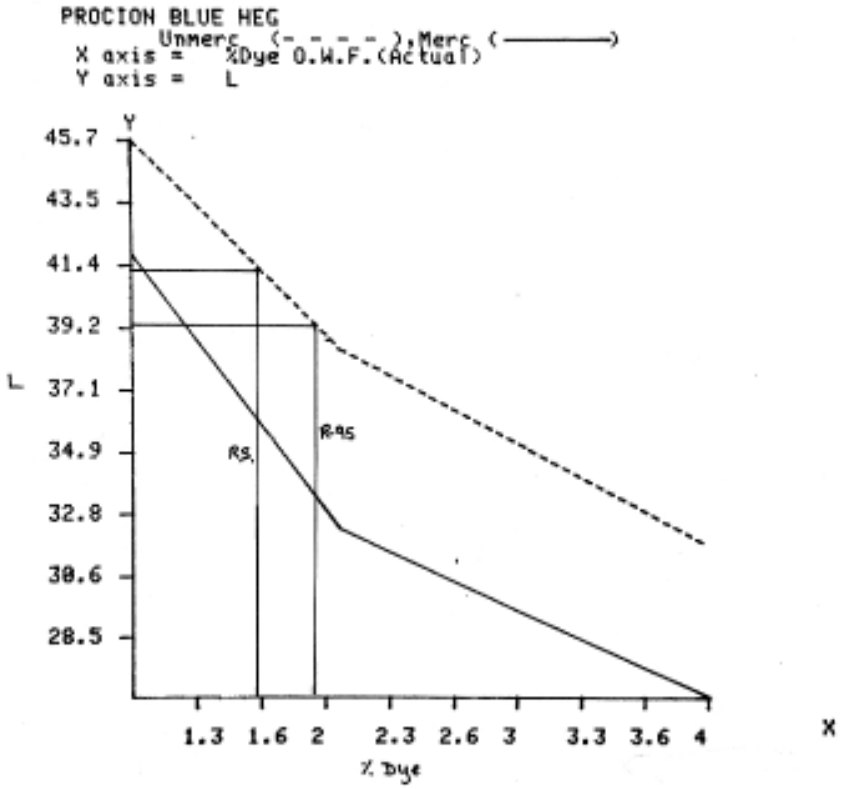


Figure 3

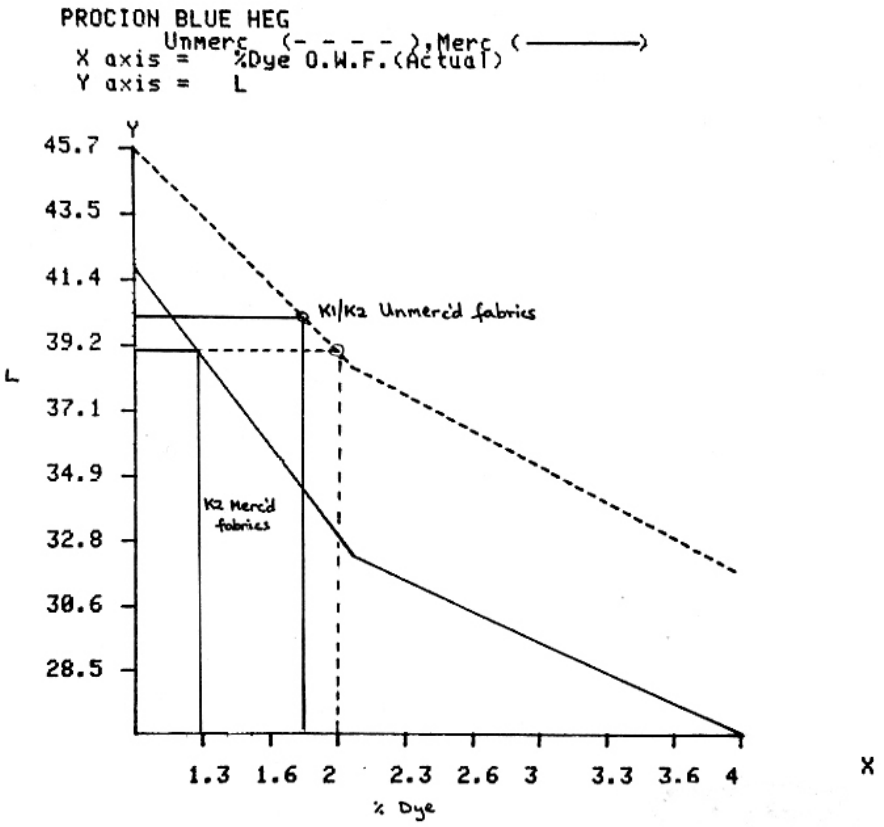
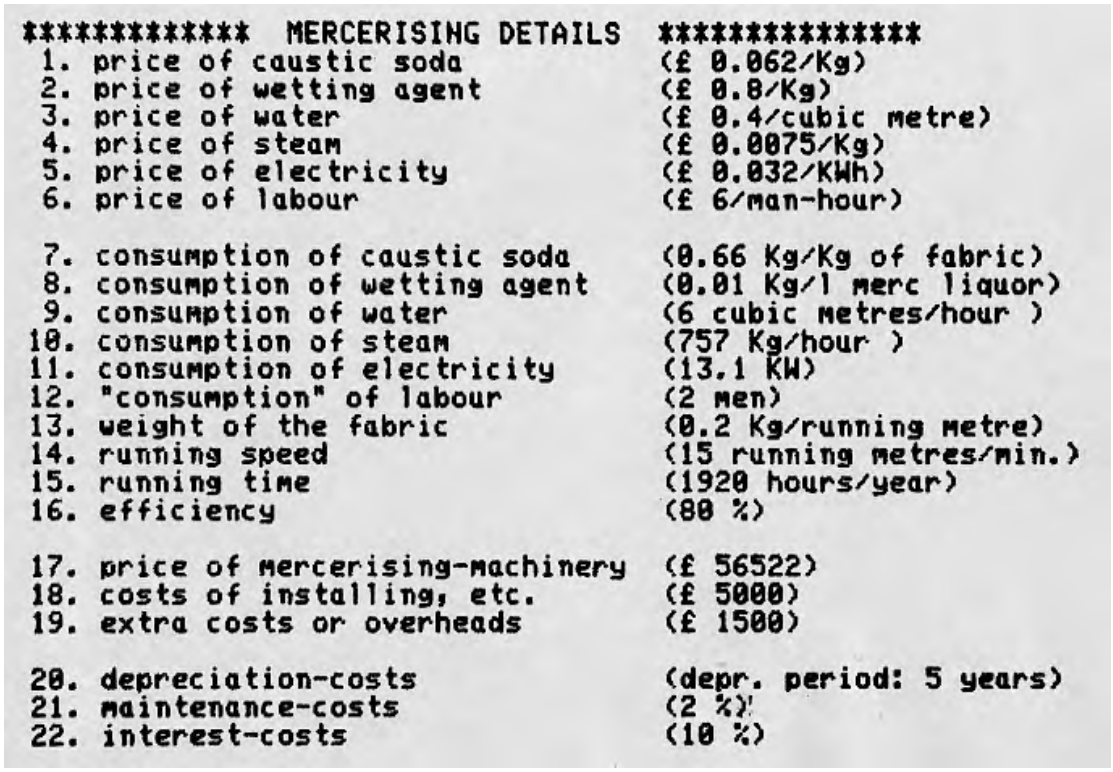


Figure 4

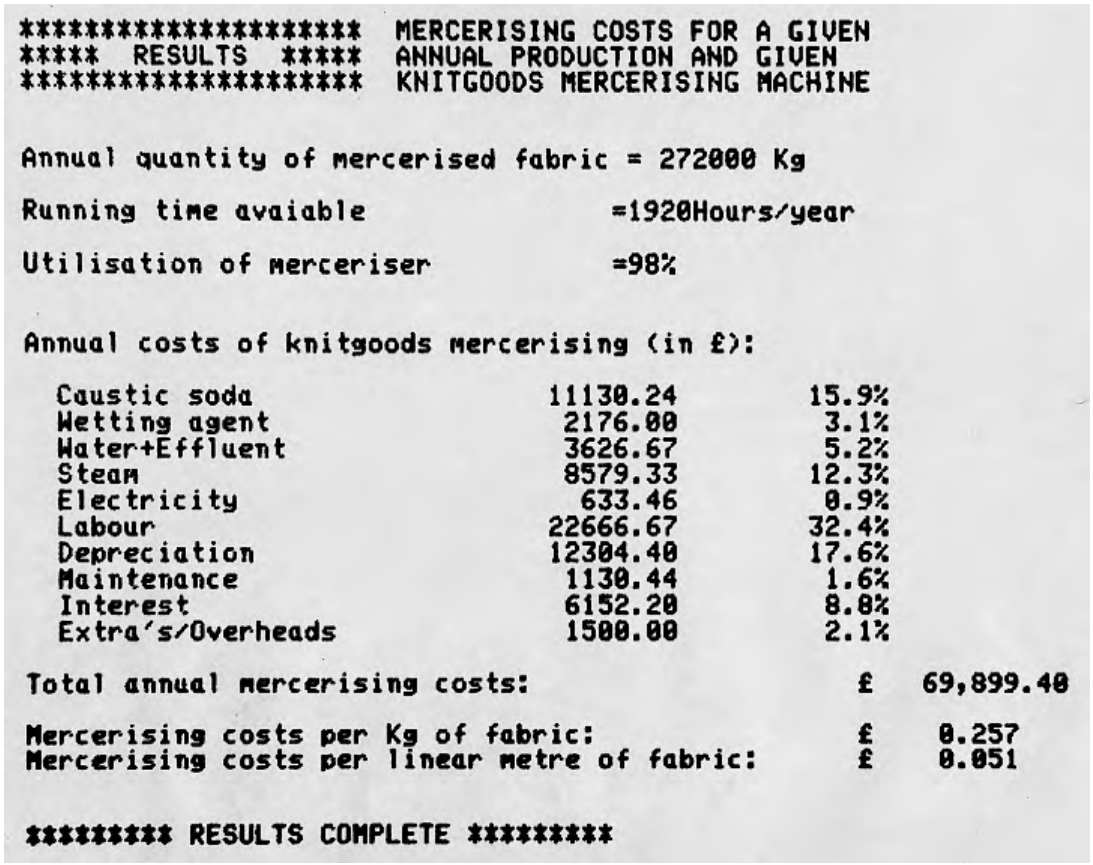
```
******** I.I.C. KNITGOODS MERCERISING ECONOMIC MODEL ********

This model will predict for the given set of production
figures and mercerising conditions below how the ultimate
          cost/Kg of the fabric may be influenced.

1.MERCERISING PROCESS COSTS - Cost catergories are itemised
                             and major costs identified.
2.TOTAL ANNUAL COSTS -------- Predicts mill costs before and
after merceriser installation when dye savings considered.
3.GRAPH ----Assuming 3 shift availability predicts how total
 cost of merc fabric reduces as merc prod increases.End point
of each curve indicates max capacity of merc at speed stated


***************  MILL DETAILS  ***************
 1. total production of fabric       (1000 tonnes/year)
 2. % coloured of tot. production    (60 %)
 3. % pastels, mediums and deeps     (25, 50, 25 % of coloured)
 4. % of pastels, mediums, deeps
    and whites to be mercerised      (42, 42, 42 & 5 %)
 5. Kg dyestuff per 100 Kg unmerce-
    rised fabric                     (pastels:0.6 med.:2 deeps:5)
 6. savings in dyestuff due to
    mercerizing(in %)                (pastels:25 med.:40 deeps:60)
 7. price of dyestuff                (£ 15/Kg)
 8. process costs for dyeing         (£ 0.4/Kg)
 9. additional processing costs                 not mercerised/mercerised
    (incl. bleaching)in £/Kg         pastels:    0.4            0.4
                                     mediums:    0.4            0.4
                                     deeps:      0.3            0.3
                                     whites:     0.4            0.4
10. mercerizing details
Press RETURN for a listing of mercerizing details
```

Figure 5



```
**********  MERCERISING DETAILS  **********
 1. price of caustic soda            (£ 0.062/Kg)
 2. price of wetting agent           (£ 0.8/Kg)
 3. price of water                   (£ 0.4/cubic metre)
 4. price of steam                   (£ 0.0075/Kg)
 5. price of electricity             (£ 0.032/KWh)
 6. price of labour                  (£ 6/man-hour)

 7. consumption of caustic soda      (0.66 Kg/Kg of fabric)
 8. consumption of wetting agent     (0.01 Kg/l merc liquor)
 9. consumption of water             (6 cubic metres/hour )
10. consumption of steam             (757 Kg/hour )
11. consumption of electricity       (13.1 KW)
12. "consumption" of labour          (2 men)
13. weight of the fabric             (0.2 Kg/running metre)
14. running speed                    (15 running metres/min.)
15. running time                     (1920 hours/year)
16. efficiency                       (80 %)

17. price of mercerising-machinery   (£ 56522)
18. costs of installing, etc.        (£ 5000)
19. extra costs or overheads         (£ 1500)

20. depreciation-costs               (depr. period: 5 years)
21. maintenance-costs                (2 %)
22. interest-costs                   (10 %)
```

Figure 6



```
**********  MERCERISING COSTS FOR A GIVEN
*****  RESULTS  *****  ANNUAL PRODUCTION AND GIVEN
**********  KNITGOODS MERCERISING MACHINE

Annual quantity of mercerised fabric = 272000 Kg

Running time avaiable              =1920Hours/year

Utilisation of merceriser          =98%

Annual costs of knitgoods mercerising (in £):

  Caustic soda              11130.24        15.9%
  Wetting agent              2176.00         3.1%
  Water+Effluent             3626.67         5.2%
  Steam                      8579.33        12.3%
  Electricity                 633.46         0.9%
  Labour                    22666.67        32.4%
  Depreciation              12304.40        17.6%
  Maintenance                1130.44         1.6%
  Interest                   6152.20         8.8%
  Extra's/Overheads          1500.00         2.1%

Total annual mercerising costs:                £   69,899.40

Mercerising costs per Kg of fabric:            £    0.257
Mercerising costs per linear metre of fabric:  £    0.051

*********  RESULTS COMPLETE  *********
```

Figure 7

```
**********************   COMPARISON OF THE TOTAL PROCESSING
*****  RESULTS  *****   COSTS BEFORE & AFTER INSTALLING A
**********************          GIVEN MERCERISER

MERCERISED PRODUCTION BASED ON GIVEN PRODUCT MIX
                          (1)              (2)              (3)
                    %Product Mix     %Merc'd of (1)   %Time on merc'r
  Pastels             15.0%            42.0%            23.2%
  Mediums             30.0%            42.0%            46.3%
  Deeps               15.0%            42.0%            23.2%
  Whites              40.0%             5.0%             7.4%

Total %/Wt fabric 100%/1000Tonnes    27%/272000Kg Merc'd
-------------------------------------------------------------

ANNUAL PROCESSING COSTS FOR TOTAL MILL PRODUCTION(in£)
                                  No Merceriser      With Merceriser

Cost of dye:                    216,000.0  25.7%    171,112.0  19.8%
Processing costs for dyeing:    240,000.0  28.5%    240,000.0  27.7%
Cost of mercerising:                                 69899.0   8.1%
Cost of additional processing:  385,000.0  45.8%    385,000.0  44.5%
                                ----------------    ----------------
Total annual cost :             841,000.0 100.0%    866,011.0 100.0%

Average cost per Kg of fabric:        £0.841              £0.866

Break-even cost of merc'd fabric/Kg:                      £0.933

Net annual merc cost when dye savings considered:        £25011

Net mercerising cost/Kg of fabric:                        £0.092
```

Figure 8

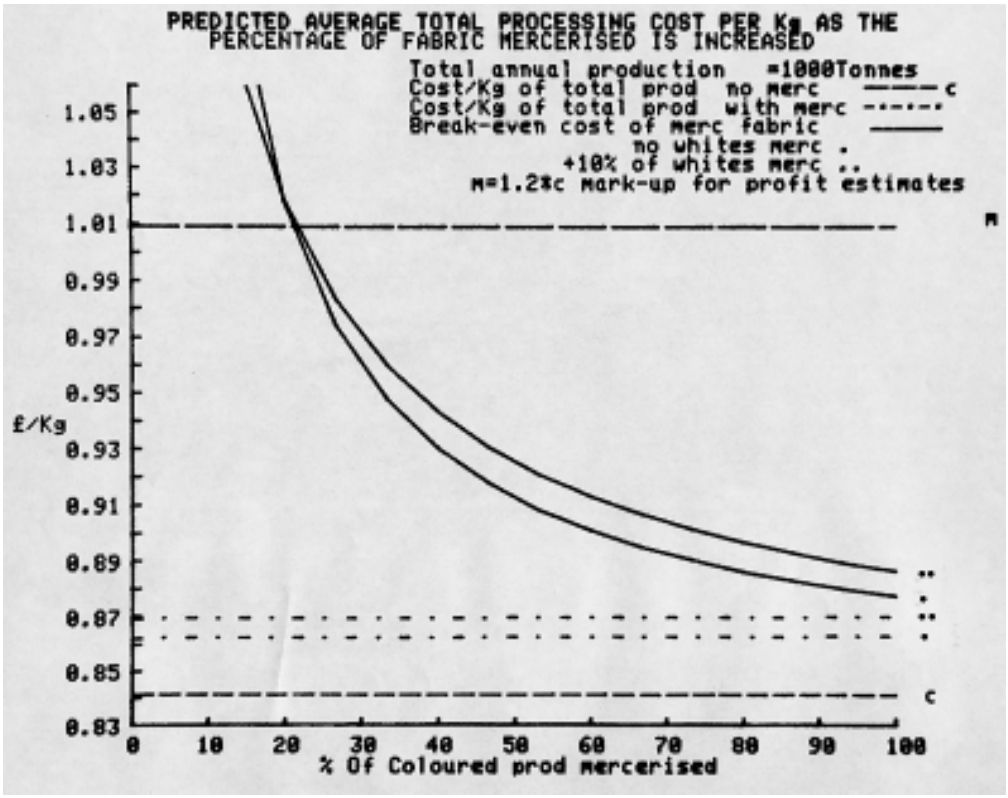
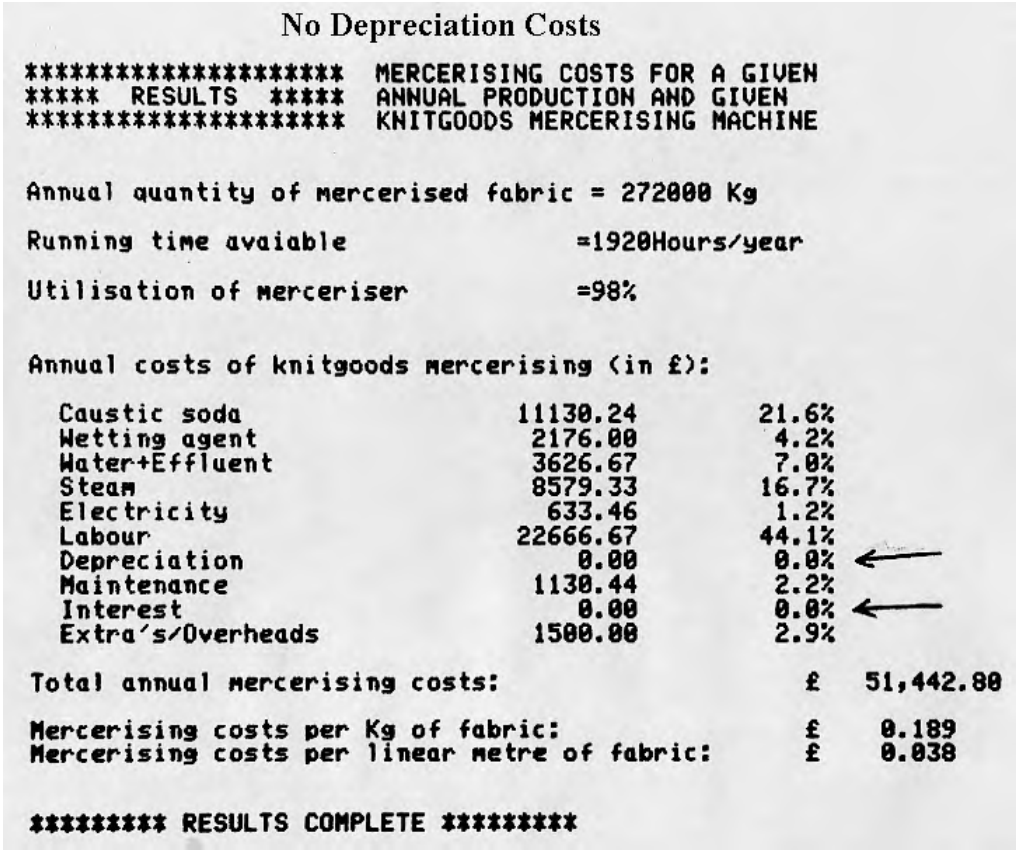


Figure 9



No Depreciation Costs

```
**********************  MERCERISING COSTS FOR A GIVEN
*****  RESULTS  *****  ANNUAL PRODUCTION AND GIVEN
**********************  KNITGOODS MERCERISING MACHINE

Annual quantity of mercerised fabric = 272000 Kg

Running time avaiable                =1920Hours/year

Utilisation of merceriser            =98%

Annual costs of knitgoods mercerising (in £):

   Caustic soda                 11130.24        21.6%
   Wetting agent                 2176.00         4.2%
   Water+Effluent                3626.67         7.0%
   Steam                         8579.33        16.7%
   Electricity                    633.46         1.2%
   Labour                       22666.67        44.1%
   Depreciation                     0.00         0.0%  <--
   Maintenance                   1130.44         2.2%
   Interest                         0.00         0.0%  <--
   Extra's/Overheads             1500.00         2.9%

Total annual mercerising costs:                    £   51,442.80

Mercerising costs per Kg of fabric:                £    0.189
Mercerising costs per linear metre of fabric:      £    0.038

*********  RESULTS COMPLETE  *********
```

Figure 10

```
**********************   COMPARISON OF THE TOTAL PROCESSING
*****  RESULTS  *****   COSTS BEFORE & AFTER INSTALLING A
**********************          GIVEN MERCERISER

MERCERISED PRODUCTION BASED ON GIVEN PRODUCT MIX
                    (1)                (2)                (3)
                %Product Mix      %Merc'd of (1)     %Time on merc'r
  Pastels          15.0%              42.0%              23.2%
  Mediums          30.0%              42.0%              46.3%
  Deeps            15.0%              42.0%              23.2%
  Whites           40.0%               5.0%               7.4%

Total %/Wt fabric 100%/1000Tonnes    27%/272000Kg Merc'd
-------------------------------------------------------------

ANNUAL PROCESSING COSTS FOR TOTAL MILL PRODUCTION(in£)
                                  No Merceriser      With Merceriser

Cost of dye:                   216,000.0  25.7%    171,112.0  20.2%
Processing costs for dyeing:   240,000.0  28.5%    240,000.0  28.3%
Cost of mercerising:                               51443.0    6.1%
Cost of additional processing: 385,000.0  45.8%    385,000.0  45.4%
                               ----------------    ----------------
Total annual cost :            841,000.0  100.0%   847,555.0  100.0%

Average cost per Kg of fabric:        £0.841              £0.848

Break-even cost of merc'd fabric/Kg:                      £0.865

Net annual merc cost when dye savings considered:        £6555

Net mercerising cost/Kg of fabric:                        £0.024
```

Figure 11

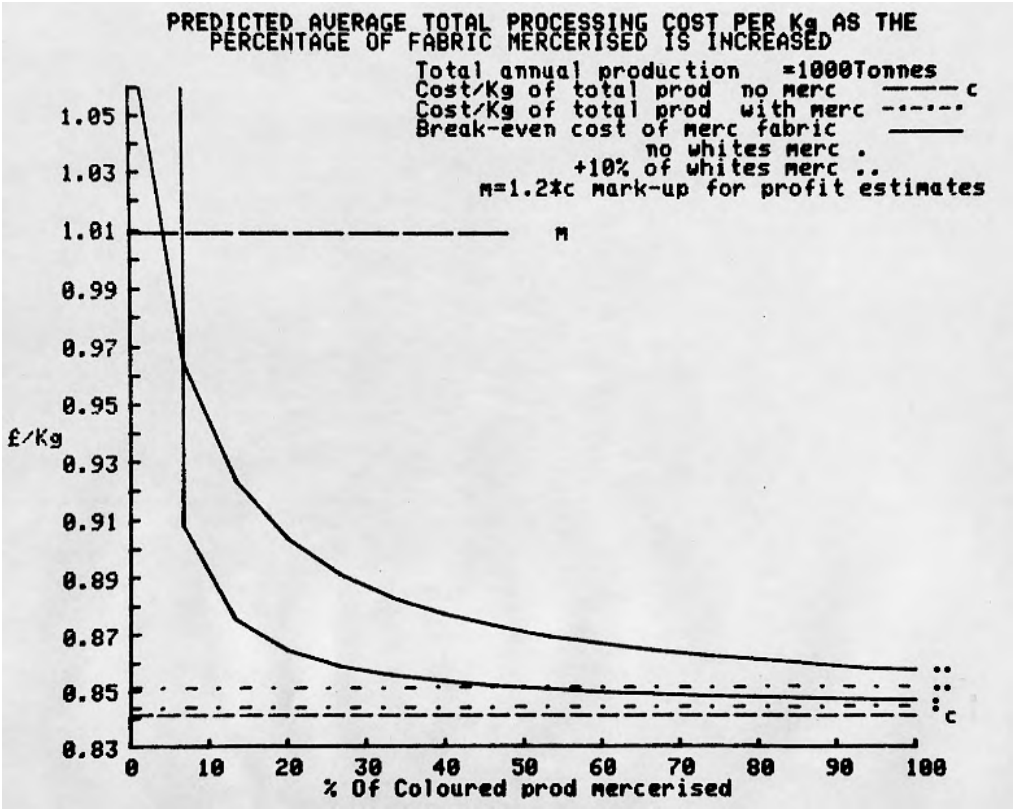
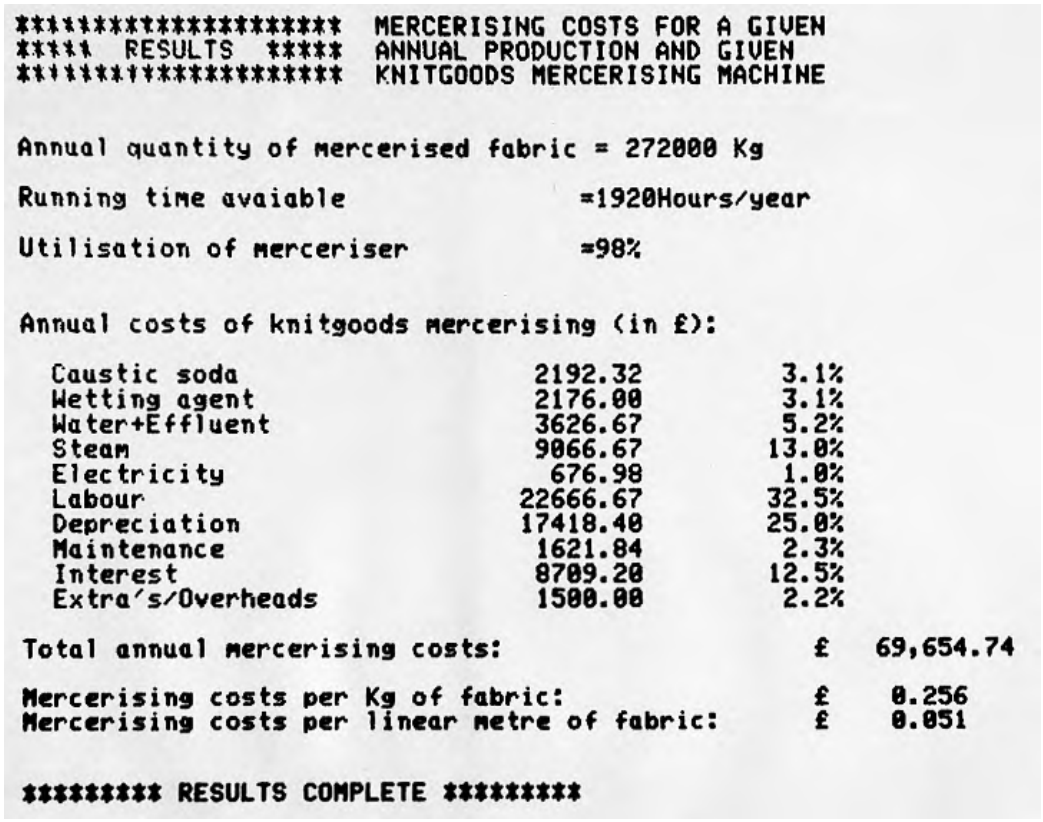


Figure 12

Caustic Recovery

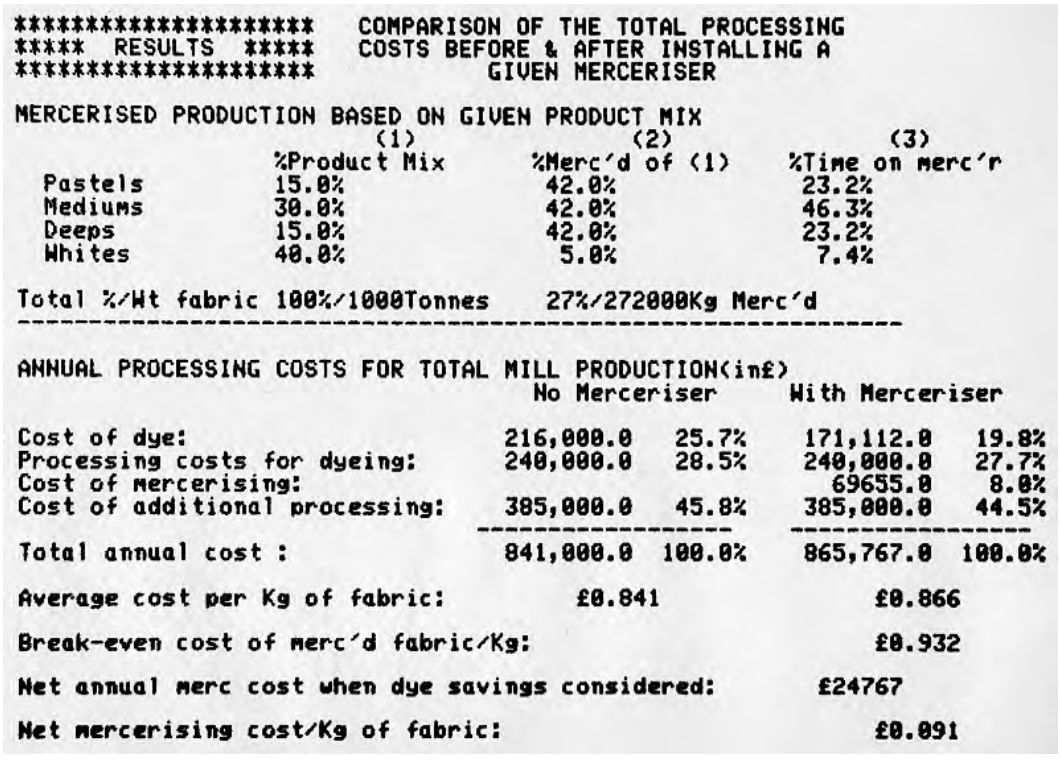
**********	MERCERISING DETAILS	**********
1.	price of caustic soda	(£ 0.062/Kg)
2.	price of wetting agent	(£ 0.8/Kg)
3.	price of water	(£ 0.4/cubic metre)
4.	price of steam	(£ 0.0075/Kg)
5.	price of electricity	(£ 0.032/KWh)
6.	price of labour	(£ 6/man-hour)
7.	consumption of caustic soda	(0.13 Kg/Kg of fabric) ←
8.	consumption of wetting agent	(0.01 Kg/l merc liquor)
9.	consumption of water	(6 cubic metres/hour)
10.	consumption of steam	(800 Kg/hour) ←
11.	consumption of electricity	(14 KW) ←
12.	"consumption" of labour	(2 men)
13.	weight of the fabric	(0.2 Kg/running metre)
14.	running speed	(15 running metres/min.)
15.	running time	(1920 hours/year)
16.	efficiency	(80 %)
17.	price of mercerising-machinery	(£ 81092) ←
18.	costs of installing, etc.	(£ 6000) ←
19.	extra costs or overheads	(£ 1500)
20.	depreciation-costs	(depr. period: 5 years)
21.	maintenance-costs	(2 %)
22.	interest-costs	(10 %)

Figure 13



```
**********************  MERCERISING COSTS FOR A GIVEN
*****  RESULTS  *****  ANNUAL PRODUCTION AND GIVEN
**********************  KNITGOODS MERCERISING MACHINE

Annual quantity of mercerised fabric = 272000 Kg

Running time avaiable                =1920Hours/year

Utilisation of merceriser            =98%

Annual costs of knitgoods mercerising (in £):

  Caustic soda                 2192.32        3.1%
  Wetting agent                2176.00        3.1%
  Water+Effluent               3626.67        5.2%
  Steam                        9066.67       13.0%
  Electricity                   676.98        1.0%
  Labour                      22666.67       32.5%
  Depreciation                17418.40       25.0%
  Maintenance                  1621.84        2.3%
  Interest                     8709.20       12.5%
  Extra's/Overheads            1500.00        2.2%

Total annual mercerising costs:                  £   69,654.74

Mercerising costs per Kg of fabric:              £    0.256
Mercerising costs per linear metre of fabric:    £    0.051

********* RESULTS COMPLETE *********
```

Figure 14



```
**********************   COMPARISON OF THE TOTAL PROCESSING
*****  RESULTS  *****   COSTS BEFORE & AFTER INSTALLING A
**********************            GIVEN MERCERISER

MERCERISED PRODUCTION BASED ON GIVEN PRODUCT MIX
                    (1)                (2)              (3)
                %Product Mix      %Merc'd of (1)    %Time on merc'r
  Pastels          15.0%             42.0%             23.2%
  Mediums          30.0%             42.0%             46.3%
  Deeps            15.0%             42.0%             23.2%
  Whites           40.0%              5.0%              7.4%

Total %/Wt fabric 100%/1000Tonnes    27%/272000Kg Merc'd
-------------------------------------------------------------

ANNUAL PROCESSING COSTS FOR TOTAL MILL PRODUCTION(in£)
                                  No Merceriser      With Merceriser

Cost of dye:                  216,000.0  25.7%   171,112.0  19.8%
Processing costs for dyeing:  240,000.0  28.5%   240,000.0  27.7%
Cost of mercerising:                              69655.0    8.0%
Cost of additional processing: 385,000.0  45.8%   385,000.0  44.5%
                              ----------------   ----------------
Total annual cost :           841,000.0 100.0%   865,767.0 100.0%

Average cost per Kg of fabric:       £0.841            £0.866

Break-even cost of merc'd fabric/Kg:                   £0.932

Net annual merc cost when dye savings considered:     £24767

Net mercerising cost/Kg of fabric:                     £0.091
```

Figure 15

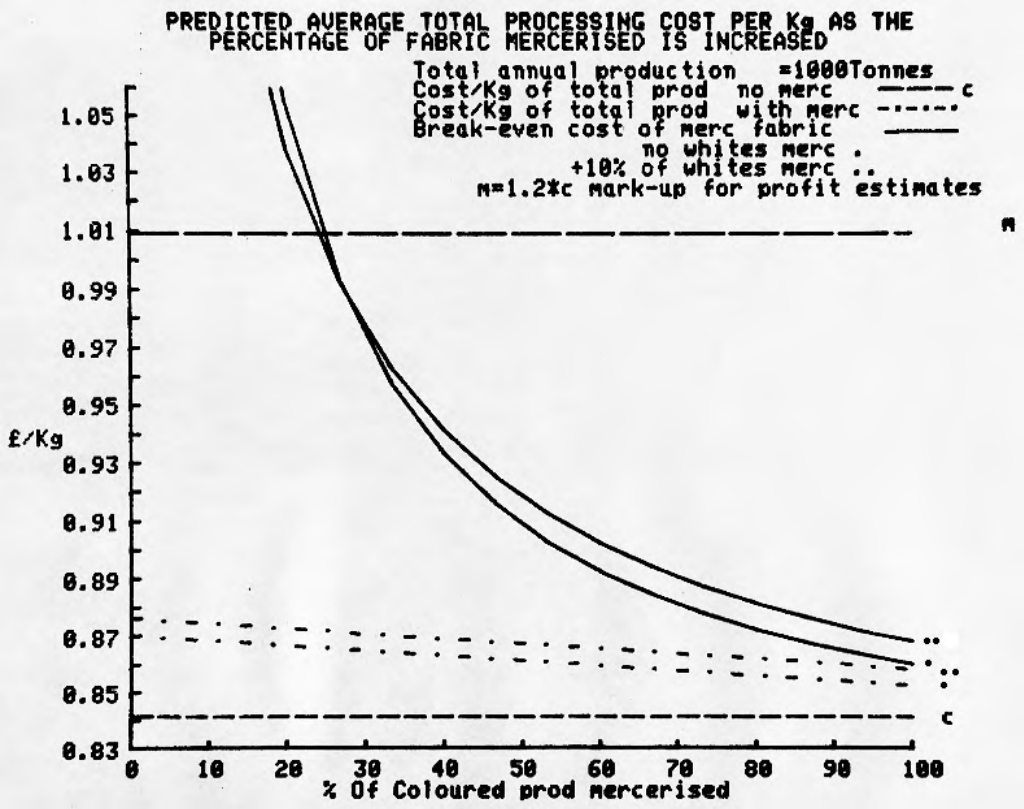


Figure 16

No Depreciation Costs + Caustic Recovery

```
**********************  MERCERISING COSTS FOR A GIVEN
*****  RESULTS  *****  ANNUAL PRODUCTION AND GIVEN
**********************  KNITGOODS MERCERISING MACHINE

Annual quantity of mercerised fabric = 272000 Kg

Running time avaiable                =1920Hours/year

Utilisation of merceriser            =98%

Annual costs of knitgoods mercerising (in £):

  Caustic soda                2192.32        5.0%
  Wetting agent               2176.00        5.0%
  Water+Effluent              3626.67        8.3%
  Steam                       9066.67       20.8%
  Electricity                  676.98        1.6%
  Labour                     22666.67       52.1%
  Depreciation                   0.00        0.0%
  Maintenance                 1621.84        3.7%
  Interest                       0.00        0.0%
  Extra's/Overheads           1500.00        3.4%

Total annual mercerising costs:                  £   43,527.14

Mercerising costs per Kg of fabric:              £    0.160
Mercerising costs per linear metre of fabric:    £    0.032

*********  RESULTS COMPLETE  *********
```

Figure 17

```
**********************   COMPARISON OF THE TOTAL PROCESSING
*****  RESULTS  *****   COSTS BEFORE & AFTER INSTALLING A
**********************          GIVEN MERCERISER

MERCERISED PRODUCTION BASED ON GIVEN PRODUCT MIX
                          (1)                (2)                (3)
                    %Product Mix      %Merc'd of (1)     %Time on merc'r
  Pastels             15.0%              42.0%              23.2%
  Mediums             30.0%              42.0%              46.3%
  Deeps               15.0%              42.0%              23.2%
  Whites              40.0%               5.0%               7.4%

Total %/Wt fabric 100%/1000Tonnes    27%/272000Kg Merc'd
-------------------------------------------------------------------

ANNUAL PROCESSING COSTS FOR TOTAL MILL PRODUCTION(in£)
                                    No Merceriser      With Merceriser

Cost of dye:                      216,000.0  25.7%   171,112.0  20.4%
Processing costs for dyeing:      240,000.0  28.5%   240,000.0  28.6%
Cost of mercerising:                                 43527.0     5.2%
Cost of additional processing:    385,000.0  45.8%   385,000.0  45.9%
                                  ---------------    ---------------
Total annual cost :               841,000.0 100.0%   839,639.0 100.0%

Average cost per Kg of fabric:        £0.841              £0.84

Break-even cost of merc'd fabric/Kg:                      £0.836

Net annual merc cost when dye savings considered:        £-1361

Net mercerising cost/Kg of fabric:                        £-0.005
```

Figure 18

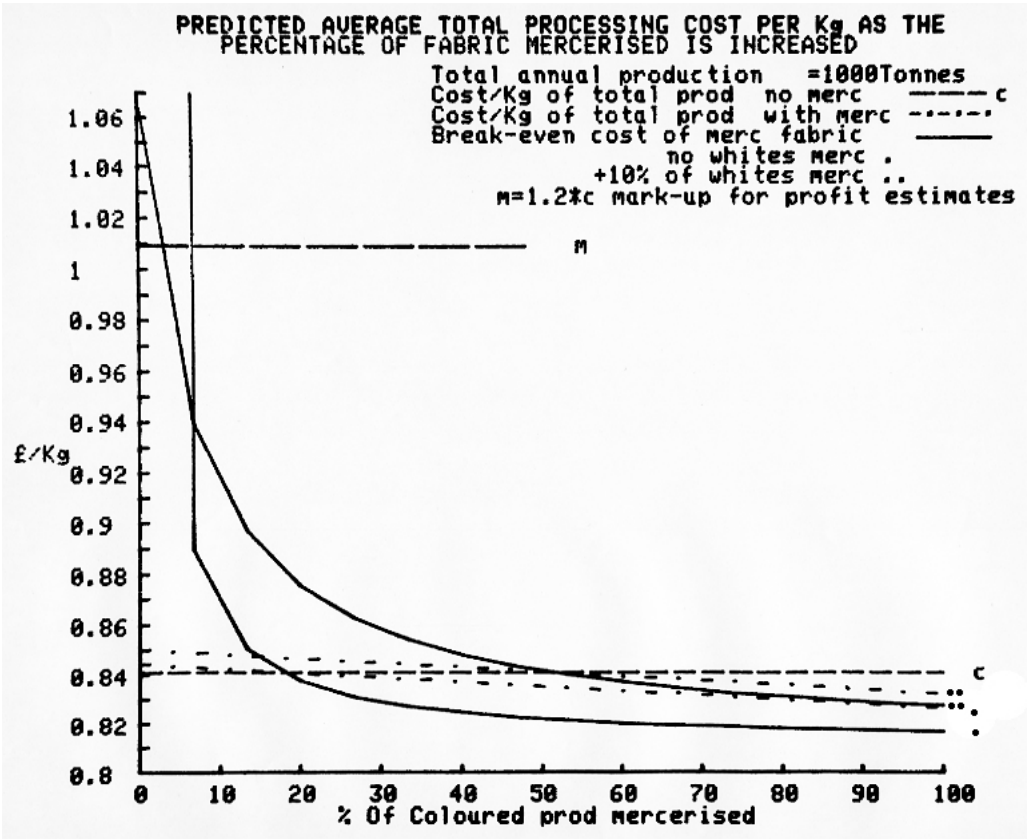
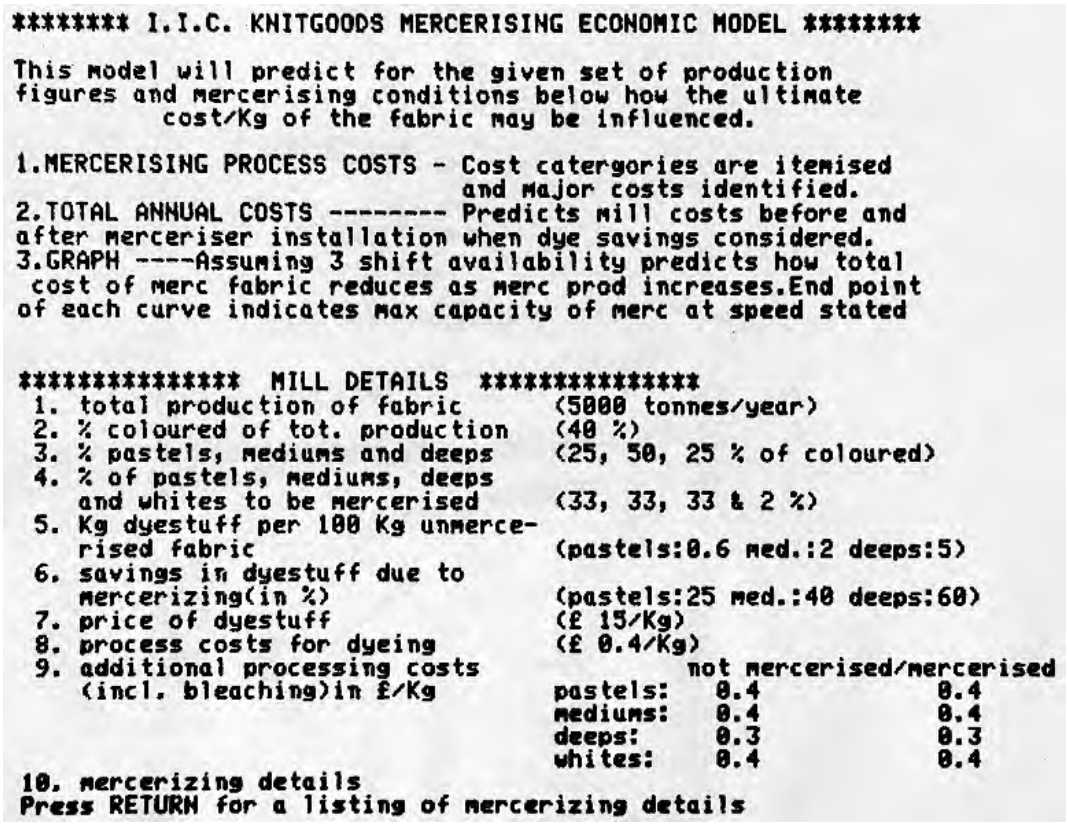
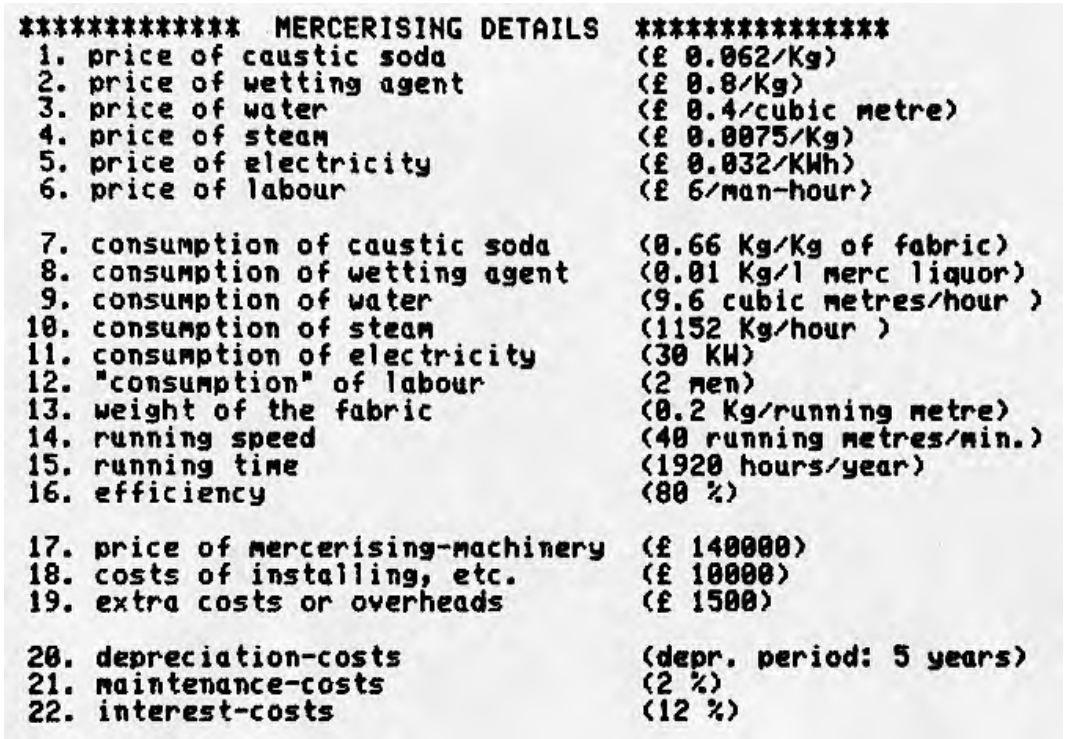


Figure 19



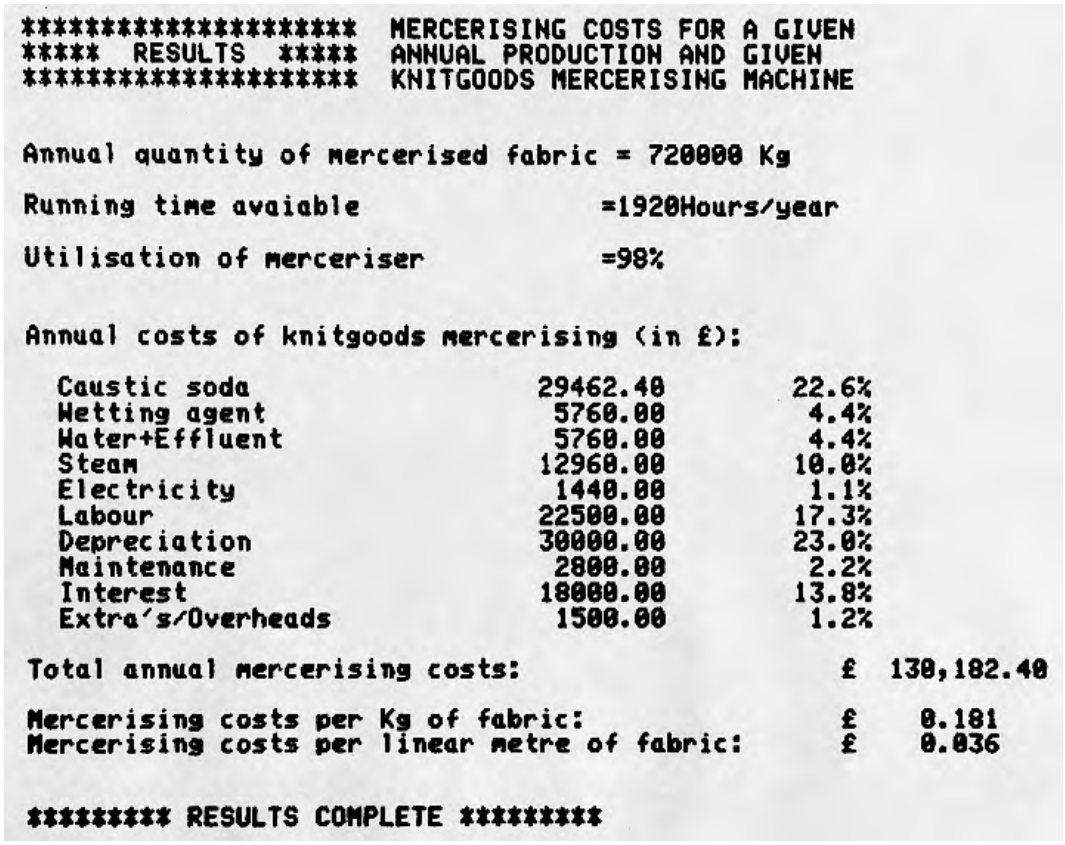
```
******** I.I.C. KNITGOODS MERCERISING ECONOMIC MODEL ********

This model will predict for the given set of production
figures and mercerising conditions below how the ultimate
          cost/Kg of the fabric may be influenced.

1.MERCERISING PROCESS COSTS - Cost catergories are itemised
                              and major costs identified.
2.TOTAL ANNUAL COSTS -------- Predicts mill costs before and
after merceriser installation when dye savings considered.
3.GRAPH ----Assuming 3 shift availability predicts how total
 cost of merc fabric reduces as merc prod increases.End point
of each curve indicates max capacity of merc at speed stated


***************  MILL DETAILS  ***************
 1. total production of fabric       (5000 tonnes/year)
 2. % coloured of tot. production    (40 %)
 3. % pastels, mediums and deeps     (25, 50, 25 % of coloured)
 4. % of pastels, mediums, deeps
    and whites to be mercerised      (33, 33, 33 & 2 %)
 5. Kg dyestuff per 100 Kg unmerce-
    rised fabric                     (pastels:0.6 med.:2 deeps:5)
 6. savings in dyestuff due to
    mercerizing(in %)                (pastels:25 med.:40 deeps:60)
 7. price of dyestuff                (£ 15/Kg)
 8. process costs for dyeing         (£ 0.4/Kg)
 9. additional processing costs                 not mercerised/mercerised
    (incl. bleaching)in £/Kg         pastels:    0.4            0.4
                                     mediums:    0.4            0.4
                                     deeps:      0.3            0.3
                                     whites:     0.4            0.4
10. mercerizing details
Press RETURN for a listing of mercerizing details
```

Figure 20



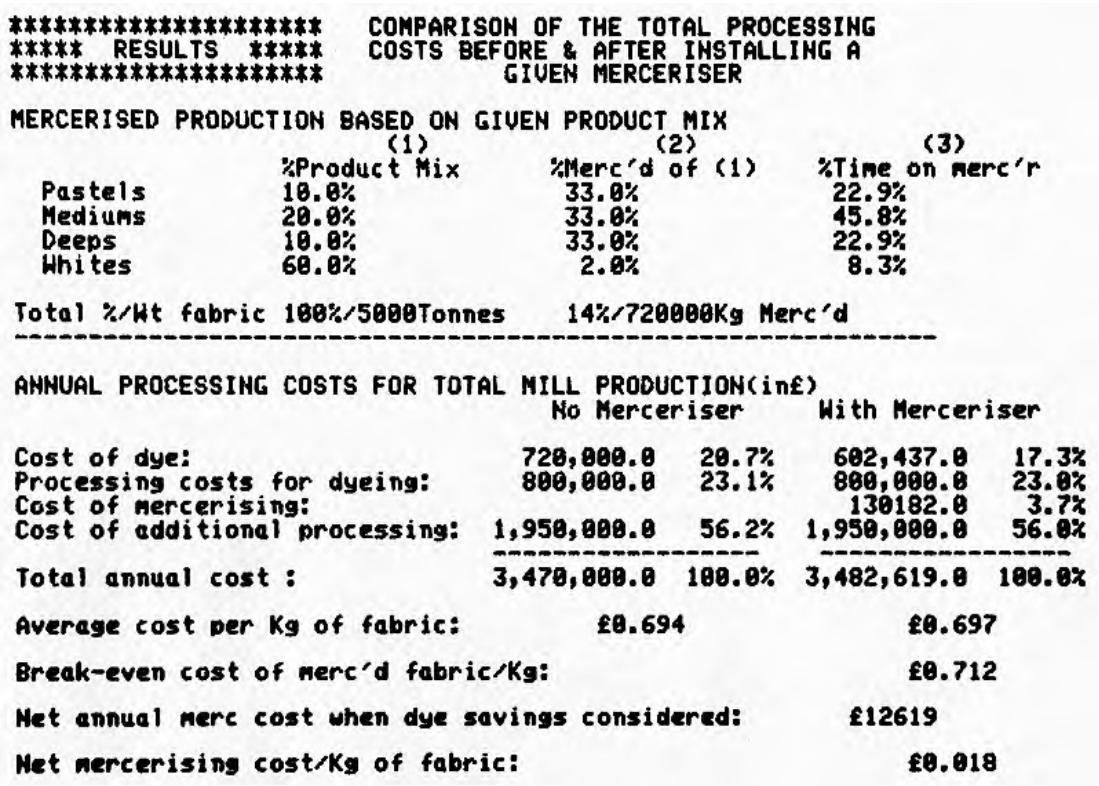
```
*************  MERCERISING DETAILS  ***************
 1. price of caustic soda            (£ 0.062/Kg)
 2. price of wetting agent           (£ 0.8/Kg)
 3. price of water                   (£ 0.4/cubic metre)
 4. price of steam                   (£ 0.0075/Kg)
 5. price of electricity             (£ 0.032/KWh)
 6. price of labour                  (£ 6/man-hour)

 7. consumption of caustic soda      (0.66 Kg/Kg of fabric)
 8. consumption of wetting agent     (0.01 Kg/l merc liquor)
 9. consumption of water             (9.6 cubic metres/hour )
10. consumption of steam             (1152 Kg/hour )
11. consumption of electricity       (30 KW)
12. "consumption" of labour          (2 men)
13. weight of the fabric             (0.2 Kg/running metre)
14. running speed                    (40 running metres/min.)
15. running time                     (1920 hours/year)
16. efficiency                       (80 %)

17. price of mercerising-machinery   (£ 140000)
18. costs of installing, etc.        (£ 10000)
19. extra costs or overheads         (£ 1500)

20. depreciation-costs               (depr. period: 5 years)
21. maintenance-costs                (2 %)
22. interest-costs                   (12 %)
```

Figure 21



```
**********************  MERCERISING COSTS FOR A GIVEN
*****  RESULTS  *****  ANNUAL PRODUCTION AND GIVEN
**********************  KNITGOODS MERCERISING MACHINE

Annual quantity of mercerised fabric = 720000 Kg

Running time avaiable                =1920Hours/year

Utilisation of merceriser            =98%

Annual costs of knitgoods mercerising (in £):

  Caustic soda                29462.40        22.6%
  Wetting agent                5760.00         4.4%
  Water+Effluent               5760.00         4.4%
  Steam                       12960.00        10.0%
  Electricity                  1440.00         1.1%
  Labour                      22500.00        17.3%
  Depreciation                30000.00        23.0%
  Maintenance                  2800.00         2.2%
  Interest                    18000.00        13.8%
  Extra's/Overheads            1500.00         1.2%

Total annual mercerising costs:                  £  130,182.40

Mercerising costs per Kg of fabric:              £    0.181
Mercerising costs per linear metre of fabric:    £    0.036

********* RESULTS COMPLETE *********
```

Figure 22



```
**********************   COMPARISON OF THE TOTAL PROCESSING
*****  RESULTS  *****   COSTS BEFORE & AFTER INSTALLING A
**********************            GIVEN MERCERISER

MERCERISED PRODUCTION BASED ON GIVEN PRODUCT MIX
                    (1)                (2)                (3)
                %Product Mix      %Merc'd of (1)     %Time on merc'r
  Pastels          10.0%              33.0%              22.9%
  Mediums          20.0%              33.0%              45.8%
  Deeps            10.0%              33.0%              22.9%
  Whites           60.0%               2.0%               8.3%

Total %/Wt fabric 100%/5000Tonnes    14%/720000Kg Merc'd
-------------------------------------------------------------

ANNUAL PROCESSING COSTS FOR TOTAL MILL PRODUCTION(in£)
                                  No Merceriser      With Merceriser

Cost of dye:                    720,000.0   20.7%    602,437.0   17.3%
Processing costs for dyeing:    800,000.0   23.1%    800,000.0   23.0%
Cost of mercerising:                                 130182.0    3.7%
Cost of additional processing: 1,950,000.0   56.2% 1,950,000.0   56.0%
                               ------------------   ------------------
Total annual cost :            3,470,000.0  100.0% 3,482,619.0  100.0%

Average cost per Kg of fabric:        £0.694              £0.697

Break-even cost of merc'd fabric/Kg:                      £0.712

Net annual merc cost when dye savings considered:       £12619

Net mercerising cost/Kg of fabric:                        £0.018
```

Figure 23

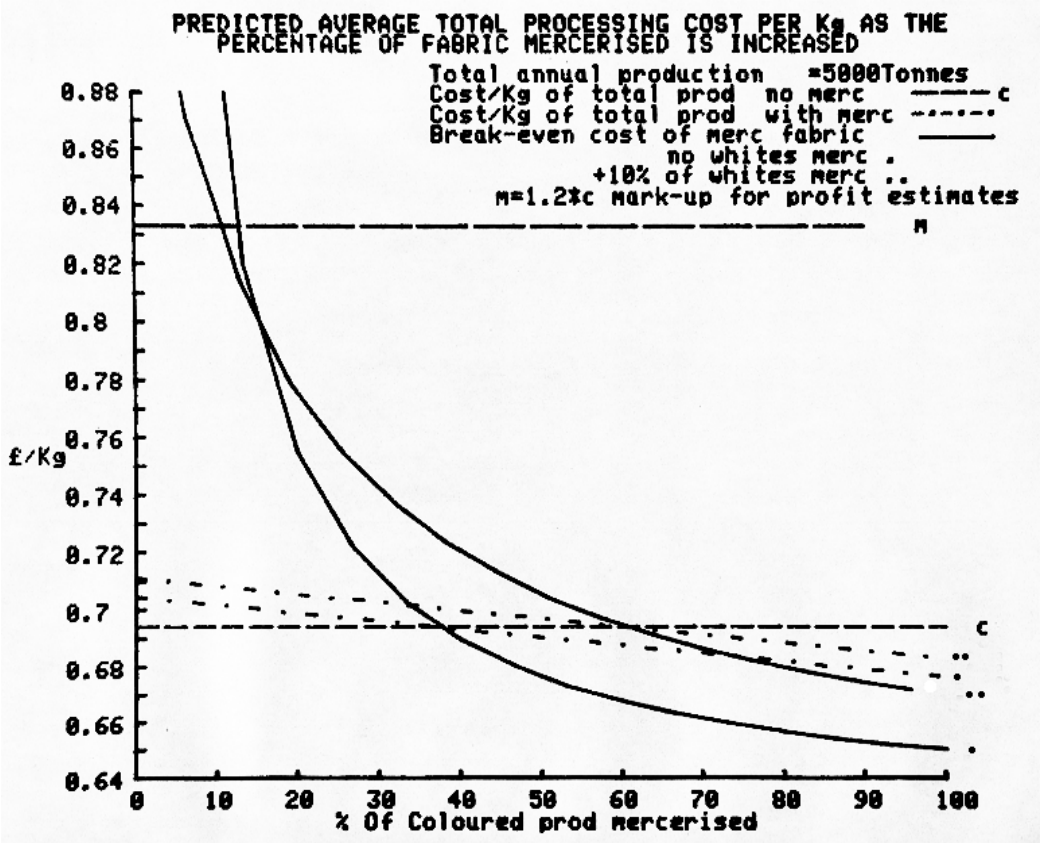


Figure 24

No Depreciation Costs

```
**********************  MERCERISING COSTS FOR A GIVEN
*****  RESULTS  *****  ANNUAL PRODUCTION AND GIVEN
**********************  KNITGOODS MERCERISING MACHINE

Annual quantity of mercerised fabric = 720000 Kg

Running time avaiable                =1920Hours/year

Utilisation of merceriser            =98%

Annual costs of knitgoods mercerising (in £):

  Caustic soda                29462.40        35.9%
  Wetting agent                5760.00         7.0%
  Water+Effluent               5760.00         7.0%
  Steam                       12960.00        15.8%
  Electricity                  1440.00         1.8%
  Labour                      22500.00        27.4%
  Depreciation                    0.00         0.0% <———
  Maintenance                  2800.00         3.4%
  Interest                        0.00         0.0% <———
  Extra's/Overheads            1500.00         1.8%

Total annual mercerising costs:                  £   82,182.40

Mercerising costs per Kg of fabric:              £    0.114
Mercerising costs per linear metre of fabric:    £    0.023

*********  RESULTS COMPLETE *********
```

Figure 25

```
**********************   COMPARISON OF THE TOTAL PROCESSING
*****  RESULTS  *****   COSTS BEFORE & AFTER INSTALLING A
**********************          GIVEN MERCERISER

MERCERISED PRODUCTION BASED ON GIVEN PRODUCT MIX
                          (1)                (2)                (3)
                    %Product Mix       %Merc'd of (1)     %Time on merc'r
  Pastels             10.0%               33.0%              22.9%
  Mediums             20.0%               33.0%              45.8%
  Deeps               10.0%               33.0%              22.9%
  Whites              60.0%                2.0%               8.3%

Total %/Wt fabric 100%/5000Tonnes    14%/720000Kg Merc'd
-------------------------------------------------------------------

ANNUAL PROCESSING COSTS FOR TOTAL MILL PRODUCTION(in£)
                                  No Merceriser      With Merceriser

Cost of dye:                      720,000.0  20.7%   602,437.0  17.5%
Processing costs for dyeing:      800,000.0  23.1%   800,000.0  23.3%
Cost of mercerising:                          -        82182.0   2.4%
Cost of additional processing:  1,950,000.0  56.2% 1,950,000.0  56.8%
                                ------------------ ------------------
Total annual cost :             3,470,000.0 100.0% 3,434,619.0 100.0%

Average cost per Kg of fabric:        £0.694              £0.687

Break-even cost of merc'd fabric/Kg:                      £0.645

Net annual merc cost when dye savings considered:        £-35381

Net mercerising cost/Kg of fabric:                        £-0.049
```

Figure 26

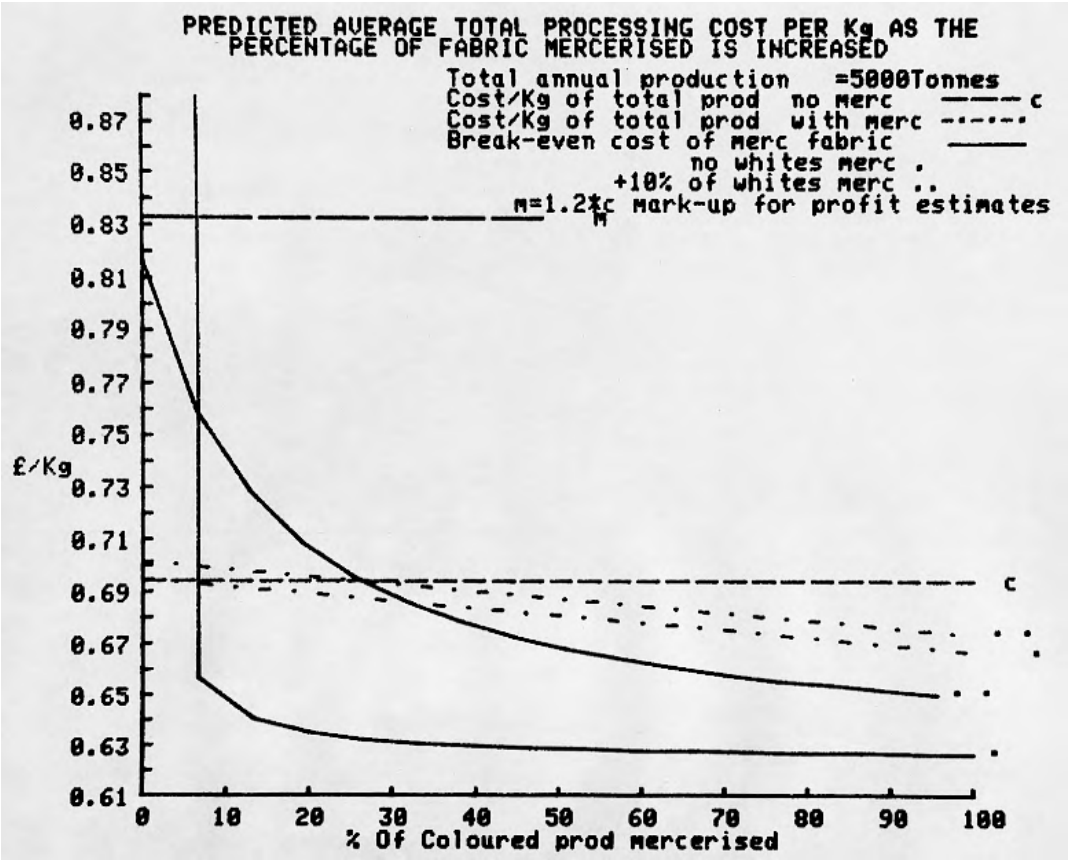


Figure 27

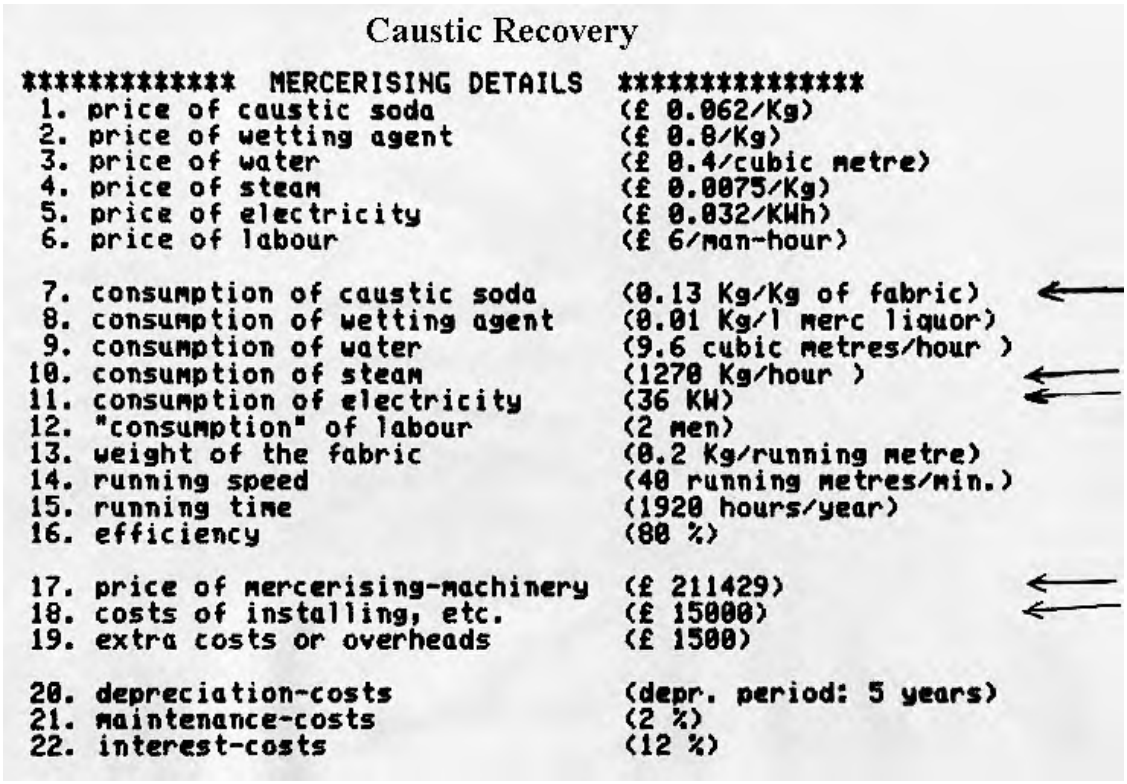


Figure 28

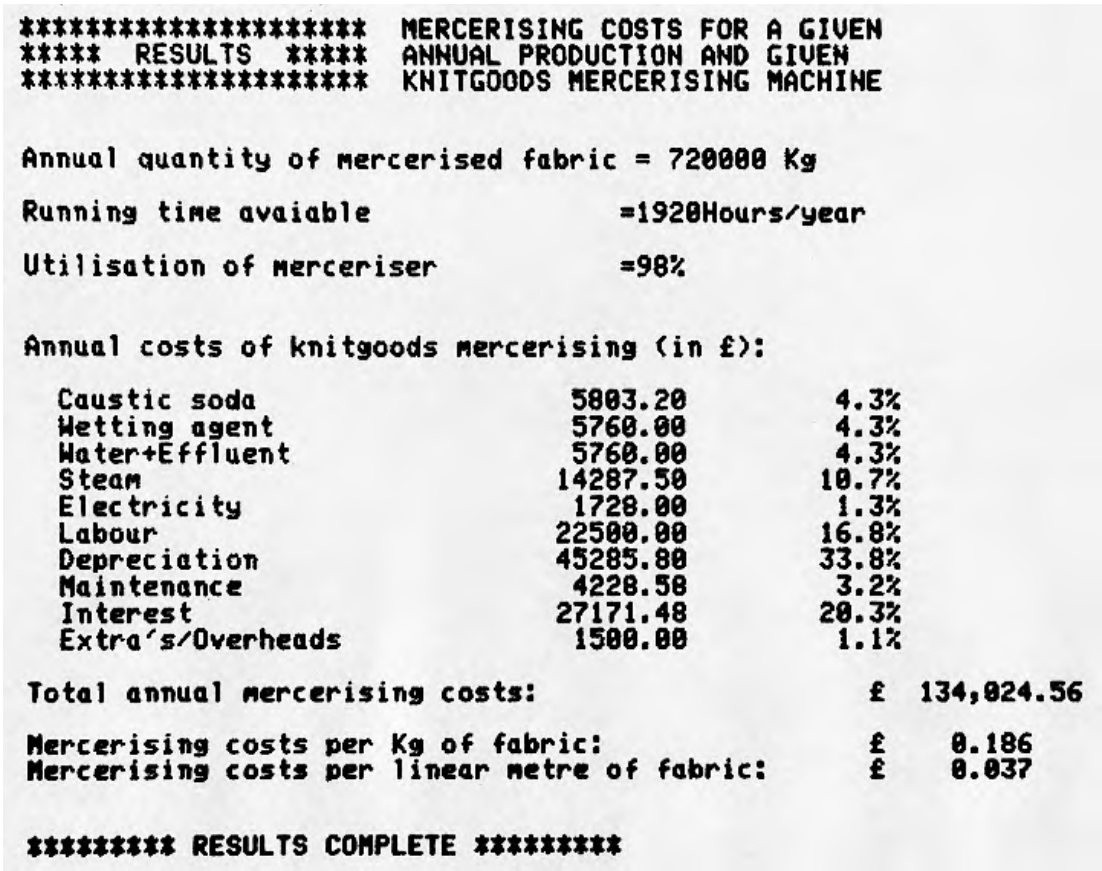


Figure 29

```
**********************   COMPARISON OF THE TOTAL PROCESSING
*****  RESULTS  *****   COSTS BEFORE & AFTER INSTALLING A
**********************            GIVEN MERCERISER

MERCERISED PRODUCTION BASED ON GIVEN PRODUCT MIX
                          (1)                (2)                (3)
                    %Product Mix      %Merc'd of (1)     %Time on merc'r
  Pastels              10.0%              33.0%              22.9%
  Mediums              20.0%              33.0%              45.8%
  Deeps                10.0%              33.0%              22.9%
  Whites               60.0%               2.0%               8.3%

Total %/Wt fabric 100%/5000Tonnes    14%/720000Kg Merc'd
-------------------------------------------------------------

ANNUAL PROCESSING COSTS FOR TOTAL MILL PRODUCTION(in£)
                                    No Merceriser      With Merceriser

Cost of dye:                      720,000.0   20.7%    602,437.0   17.3%
Processing costs for dyeing:      800,000.0   23.1%    800,000.0   22.9%
Cost of mercerising:                                   134025.0    3.8%
Cost of additional processing:  1,950,000.0   56.2%  1,950,000.0   55.9%
                                ------------------   ------------------
Total annual cost :             3,470,000.0  100.0%  3,486,462.0  100.0%

Average cost per Kg of fabric:          £0.694              £0.697

Break-even cost of merc'd fabric/Kg:                        £0.717

Net annual merc cost when dye savings considered:          £16462

Net mercerising cost/Kg of fabric:                          £0.023
```

Figure 30

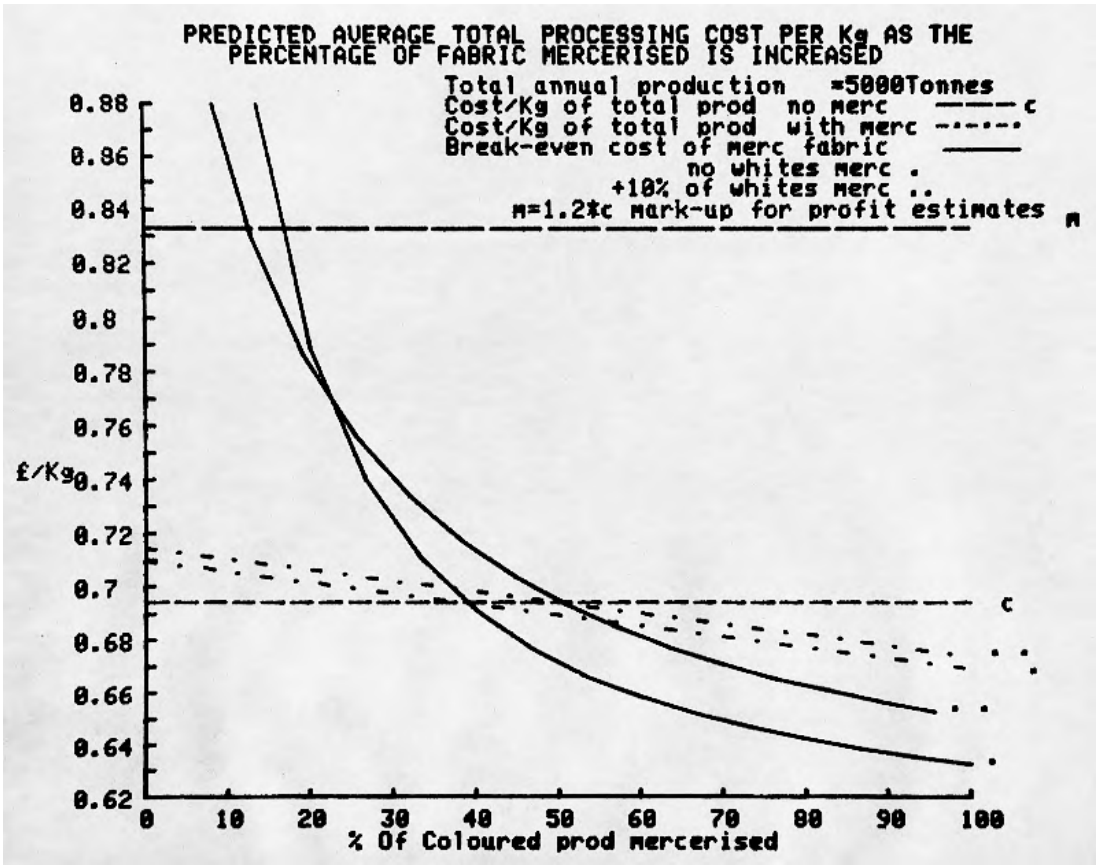
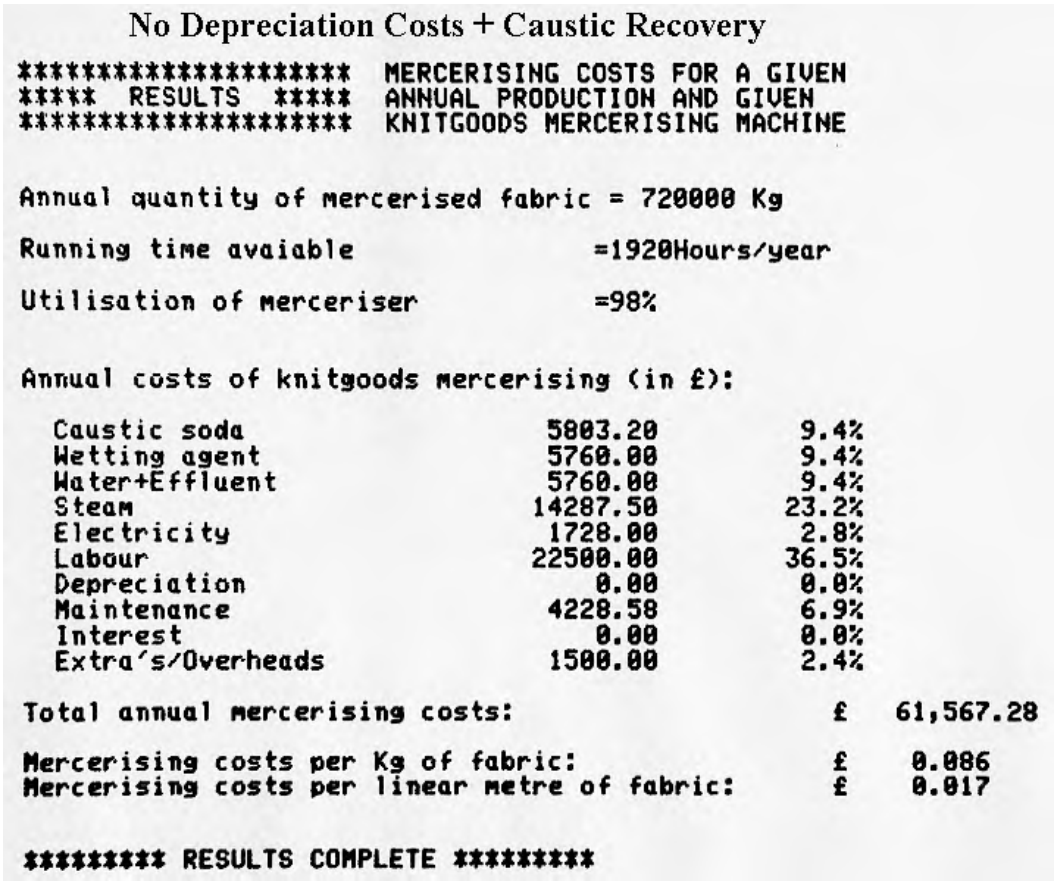


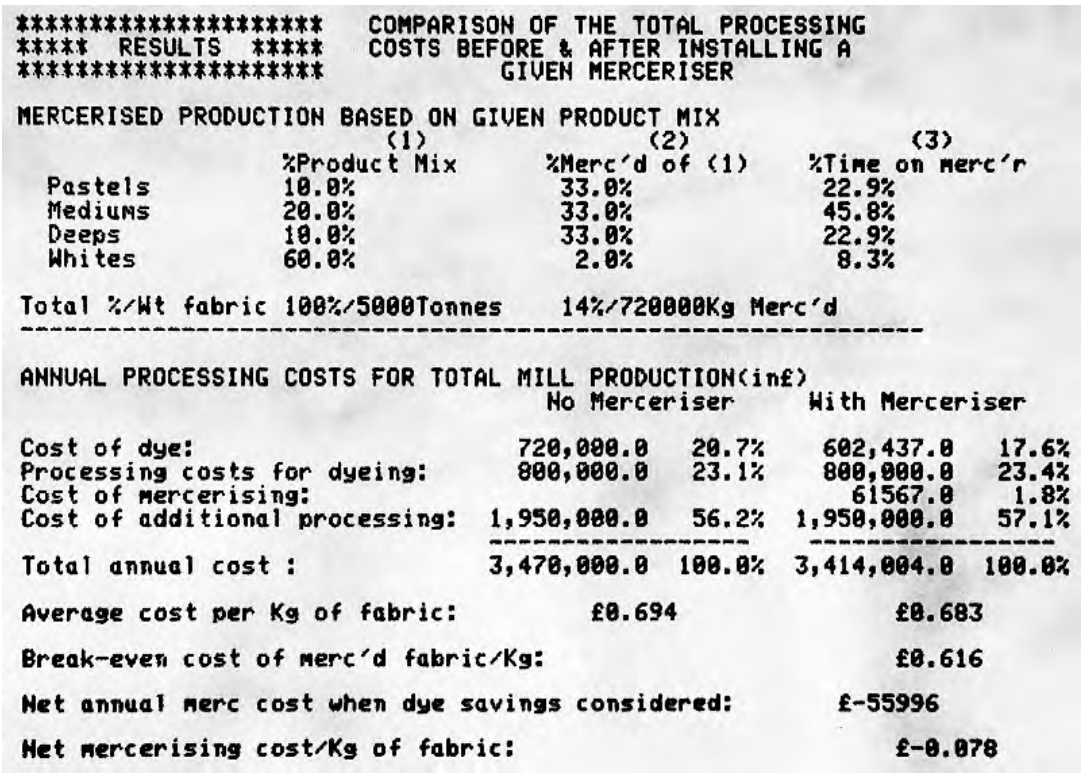
Figure 31



No Depreciation Costs + Caustic Recovery

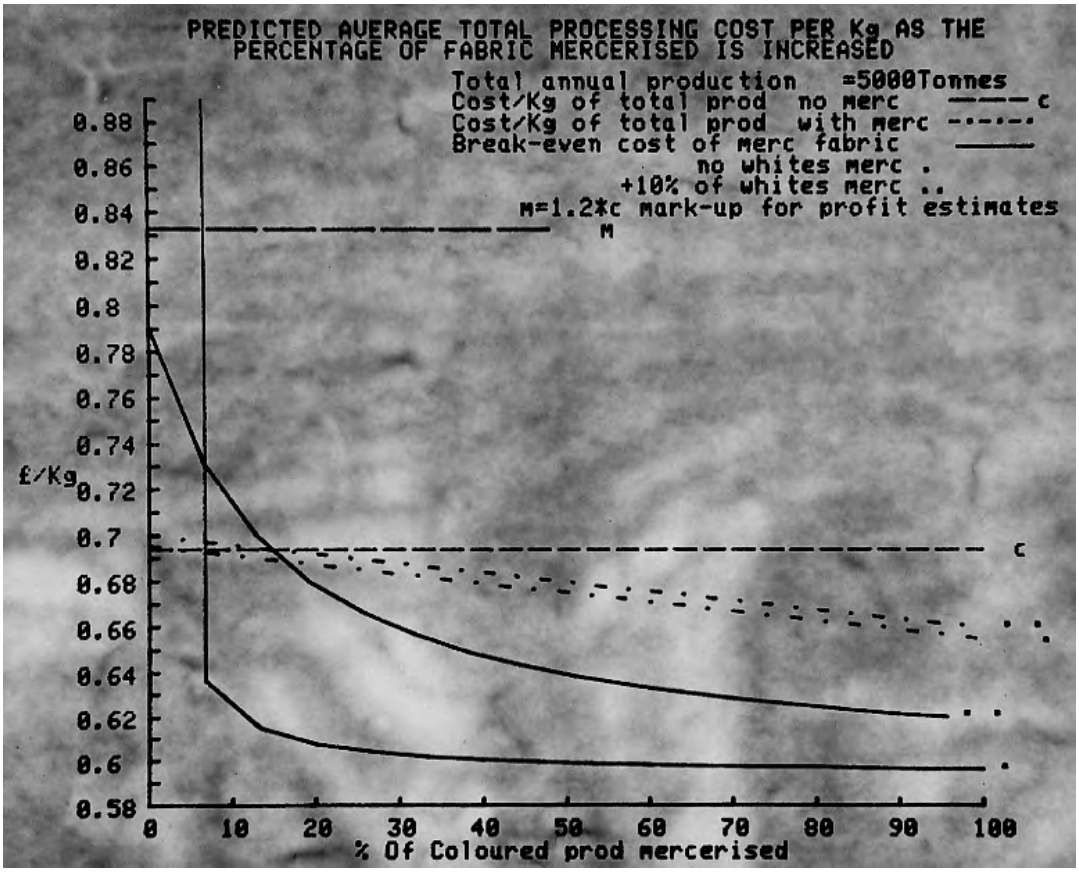
```
**********************  MERCERISING COSTS FOR A GIVEN
*****  RESULTS  *****  ANNUAL PRODUCTION AND GIVEN
**********************  KNITGOODS MERCERISING MACHINE

Annual quantity of mercerised fabric = 720000 Kg

Running time avaiable                =1920Hours/year

Utilisation of merceriser            =98%

Annual costs of knitgoods mercerising (in £):

  Caustic soda                    5803.20        9.4%
  Wetting agent                   5760.00        9.4%
  Water+Effluent                  5760.00        9.4%
  Steam                          14287.50       23.2%
  Electricity                     1728.00        2.8%
  Labour                         22500.00       36.5%
  Depreciation                       0.00        0.0%
  Maintenance                     4228.58        6.9%
  Interest                           0.00        0.0%
  Extra's/Overheads               1500.00        2.4%

Total annual mercerising costs:                  £   61,567.28

Mercerising costs per Kg of fabric:              £    0.086
Mercerising costs per linear metre of fabric:    £    0.017

*********  RESULTS COMPLETE *********
```

Figure 32



```
**********************   COMPARISON OF THE TOTAL PROCESSING
*****  RESULTS  *****   COSTS BEFORE & AFTER INSTALLING A
**********************            GIVEN MERCERISER

MERCERISED PRODUCTION BASED ON GIVEN PRODUCT MIX
                    (1)              (2)              (3)
                %Product Mix    %Merc'd of (1)   %Time on merc'r
  Pastels          10.0%           33.0%            22.9%
  Mediums          20.0%           33.0%            45.8%
  Deeps            10.0%           33.0%            22.9%
  Whites           60.0%            2.0%             8.3%

Total %/Wt fabric 100%/5000Tonnes    14%/720000Kg Merc'd
-------------------------------------------------------------

ANNUAL PROCESSING COSTS FOR TOTAL MILL PRODUCTION(in£)
                                  No Merceriser      With Merceriser

Cost of dye:                    720,000.0   20.7%   602,437.0   17.6%
Processing costs for dyeing:    800,000.0   23.1%   800,000.0   23.4%
Cost of mercerising:                                 61567.0    1.8%
Cost of additional processing: 1,950,000.0   56.2% 1,950,000.0   57.1%
                               ------------------  ------------------
Total annual cost :            3,470,000.0  100.0% 3,414,004.0  100.0%

Average cost per Kg of fabric:        £0.694              £0.683

Break-even cost of merc'd fabric/Kg:                      £0.616

Net annual merc cost when dye savings considered:       £-55996

Net mercerising cost/Kg of fabric:                        £-0.078
```

Figure 33


PREDICTED AVERAGE TOTAL PROCESSING COST PER Kg AS THE PERCENTAGE OF FABRIC MERCERISED IS INCREASED
Total annual production =5000Tonnes
Cost/Kg of total prod no merc ——— c
Cost/Kg of total prod with merc -.-.-.-
Break-even cost of merc fabric ———
no whites merc .
+10% of whites merc ..
M=1.2*c mark-up for profit estimates
M
c
£/Kg
0.88
0.86
0.84
0.82
0.8
0.78
0.76
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0
10
20
30
40
50
60
70
80
90
100
% Of Coloured prod mercerised