

A STUDY OF COLORFASTNESS TO LAUNDERING OF CERTAIN
PERCALES BEARING TWO DIFFERENT LABELS

APPROVED: *copy 2*

Muriel E. Williams
Major Professor

Merle E. Bonney
Minor Professor

Florence J. Scoulor
Director of the Department of Home Economics

L. A. Sharp
Dean of the Graduate Division

A STUDY OF COLORFASTNESS TO LAUNDERING OF CERTAIN
PERCALES BEARING TWO DIFFERENT LABELS

THESIS

Presented to the Graduate Council of the North
Texas State Teachers College in Partial
Fulfillment of the Requirements

For the Degree of

MASTER OF SCIENCE

By

Nona L. Griffith, B. S.

110059

Denton, Texas

August, 1943

110059

TABLE OF CONTENTS

	Page
LIST OF TABLES	iv
LIST OF ILLUSTRATIONS	v
Chapter	
I. INTRODUCTION	1
II. PROCEDURE	3
III. DISCUSSION OF RESULTS	9
IV. SUMMARY	26
APPENDIX	27
BIBLIOGRAPHY	46

LIST OF TABLES

Table	Page
1. The Color, Price, and Label of Each Sample of Percalé	4
2. The Degree to Which Each Type of Fading Was Evident in Each Sample Labeled "Fast to Washing" in the First, Tenth, and Twentieth Washings When Using Detergent A	10
3. The Degree to Which Each Type of Fading Was Evident in Each Sample Labeled "Guaranteed Fast Color" in the First, Tenth, and Twentieth Washings When Using Detergent A	12
4. The Degree to Which Each Type of Fading was Evident in Each Sample Labeled "Fast to Washing" in the First, Tenth, and Twentieth Washings When Using Detergent B	15
5. The Degree to Which Each Type of Fading Was Evident in Each Sample Labeled "Guaranteed Fast Color" in the First, Tenth, and Twentieth Washings When Using Detergent B	17
6. The Degree to Which Each Type of Fading Was Evident in Each Standard Sample in the First, Tenth, and Twentieth Washings When Using Detergent A	21
7. The Degree to Which Each Type of Fading Was Evident in Each Standard Sample in the First, Tenth, and Twentieth Washings When Using Detergent B	23
8. Degrees of Temperature (Fahrenheit) of Wash and Rinse Waters When Using Each Detergent	27

LIST OF ILLUSTRATIONS

Plate		Page
1.	Samples 1 and 2 before washing, and after first, tenth, and twentieth washings with detergent A	28
2.	Samples 1 and 2 before washing, and after first, tenth, and twentieth washings with detergent B	29
3.	Samples 3 and 4 before washing, and after first, tenth, and twentieth washings with detergent A	30
4.	Samples 3 and 4 before washing, and after first, tenth, and twentieth washings with detergent B	31
5.	Samples 5 and 6 before washing, and after first, tenth, and twentieth washings with detergent A	32
6.	Samples 5 and 6 before washing, and after first, tenth, and twentieth washings with detergent B	33
7.	Samples 7 and 8 before washing, and after first, tenth, and twentieth washings with detergent A	34
8.	Samples 7 and 8 before washing, and after first, tenth, and twentieth washings with detergent B	35
9.	Samples 9 and 10 before washing, and after first, tenth, and twentieth washings with detergent A	36
10.	Samples 9 and 10 before washing, and after first, tenth, and twentieth washings with detergent B	37

Plate	Page
11. Samples 11 and 12 before washing, and after first, tenth, and twentieth washings with detergent A	38
12. Samples 11 and 12 before washing, and after first, tenth, and twentieth washings with detergent B	39
13. Samples 13 and 14 before washing, and after first, tenth, and twentieth washings with detergent A	40
14. Samples 13 and 14 before washing, and after first, tenth, and twentieth washings with detergent B	41
15. Samples 15 and 15 before washing, and after first, tenth, and twentieth washings with detergent A	42
16. Samples 15 and 16 before washing, and after first, tenth, and twentieth washings with detergent B	43
17. Standard samples before washing, and after first, tenth, and twentieth washings with detergent A	44
18. Standard samples before washings, and after first, tenth, and twentieth washings with detergent B	45

CHAPTER I

INTRODUCTION

Percales, commonly known as cotton prints, are fabrics frequently used in women's house dresses and children's clothing. These garments are usually cleaned by laundering, therefore colorfastness to this method of cleaning is an important factor in the serviceability of such garments.

"Serviceability of fabrics," as defined by Skinkle,¹ "is its length of life up to the end of its usefulness. In clothing the end of service is generally when due to color fading or shrinkage in laundering the garment no longer has a presentable appearance."

Edgerton, in 1938, said:

There is at the present time no phase of our industry in greater need of standardization than in the matter of colorfastness of printed cotton fabrics, and in the interpretation and guarantee of this factor to the consumer. There are so many different phrases used in guaranteeing or designating colorfastness and so many interpretations of the degree of fastness required to fulfill these guarantees that present conditions resemble a contest in which each participant makes up his own rules as he goes along and to best suit his own convenience.²

¹John W. Skinkle, Textile Testing, p. 97.

²E. M. Edgerton, "Fastness Requirements of Printed Cottons," American Dyestuff Reporter, XXVI (1938), 320.

Edgerton also discusses the need for more specific wording of guarantees so that the consumer may know what to expect of the guarantee.³

The confusion in the interpretation of colorfast guarantees is also referred to in the Federal Trade Commission's Proposed Trade Practice Rules⁴ of August 5, 1942.

Textile groups which met in New York in 1942 advocated a descriptive method of labeling of textiles, using a phraseology understood by the average woman.⁵

Because of the uncertainty of these labels, the present study is to compare the fading properties due to home laundering methods of certain percales bearing printed labels, "Guaranteed Fast Color," with samples representing similar colors labeled, "Fast to Washing."

³Ibid.

⁴Federal Trade Commission, Proposed Trade Practice Rules Relating to the Colorfastness of Textiles, Bulletin.

⁵"Seek Workable Fastness Rules," Textile World, XCII (October, 1942), 97.

CHAPTER II

PROCEDURE

Sixteen pieces of printed percales, eight labeled "Guaranteed Fast Color" and eight of similar colors labeled "Fast to Washing," were used in this study. These fabrics were chosen so as to give a wide range in color, but in as near the same price range as possible. The prices ranged from twenty-five to thirty-five cents per yard. Information regarding price, color, and label is given in Table 1.

Six inches of each percale were purchased and after taking out a piece six by six inches to use as control, the remainder of each fabric was cut into pieces six by fifteen inches and then sewed onto large strips of white muslin which had been desized by washing until all evidence of sizing and dressing had disappeared. The right side of the percale was placed next to the white cloth for the purpose of determining whether or not the dye in the printed fabrics would "bleed" when subjected to washing.¹ This method also aided in the handling of the test samples.

The pieces were stitched to the muslin by machine

¹Ethel M. Phelps, A Laboratory Manual for Advanced Courses in Textiles, p. 94.

TABLE 1
 THE COLOR, PRICE, AND LABEL OF EACH
 SAMPLE OF PERCALE

Sample Number	Color of Percales	Price Per Yard	Label
1...	Green, white.	.35	"Fast to Washing"
2...	Green, white	.25	"Guaranteed Fast Color"
3...	Red, white	.35	"Fast to Washing"
4...	Red, white	.35	"Guaranteed Fast Color"
5...	Red, white	.29	"Fast to Washing"
6...	Red, white	.29	"Guaranteed Fast Color"
7...	Pink, blue, wine, white, green	.27	"Fast to Washing"
8...	Pink, blue, wine, white, red	.35	"Guaranteed Fast Color"
9...	Navy, white	.35	"Fast to Washing"
10...	Navy, white	.35	"Guaranteed Fast Color"
11...	Yellow, red, white, green, wine	.27	"Fast to Washing"
12...	Yellow, red, white, blue, grey	.25	"Guaranteed Fast Color"
13...	Blue, red, green, white, yellow	.27	"Fast to Washing"

TABLE 1 -- Continued

Sample Number	Color of Percales	Price Per Yard	Label
14...	Blue, red, green, white, rose, navy	.35	"Guaranteed Fast Color"
15...	Brown, white	.29	"Fast to Washing"
16...	Brown, white	.29	"Guaranteed Fast Color"

with a long stitch around the edges to prevent raveling and stitched twice through the center, marking the sample into thirds. One third was taken off after the first, tenth, and twentieth washing, respectively. Each piece was carefully marked for identification as to colorfastness, number of washings, and kind of detergent used.

Swatches of "Cotton Standards for Fastness to Washing," were obtained from the American Association of Textile Chemists and Colorists² and washed with the test samples because the fastness of color of the test samples should be determined by comparison with the fastness of a reference standard dyeing tested in the same way and at the same time.³

²American Association of Textile Chemists and Colorists, Cotton Standards for Fastness to Washing (C. W.).

³Committee D-13, A. S. T. M. Standards on Textile Materials, bulletin of the American Society for Testing Materials, October, 1940, p. 77.

A control sample was taken from each of these and the remainder was sewed to desized white muslin in the same manner as the percale samples.

The washing of the materials was carried out under home conditions using a round-tub electric washing machine of the gyrator type with a capacity of fourteen gallons of water.

Tap water from the city supply was used. When analyzed,⁴ it was found to have a total hardness of 24.7 parts per million, all of which was to be accounted for by carbonate hardness. There was present in excess over neutral 291 parts per million of alkalinity due to carbonate and bicarbonate. There was iron and aluminum present to the extent of 6.4 parts per million and fluoride to .34 of a part per million. There was also present .25 part per million of free chlorine.⁵

The detergents selected for use in this study were the two commercial brands most used in this community and representative of two different types of laundry soap. This was determined by checking the kinds and amounts of soaps sold in the grocery stores of this community. Detergent "A" was a bar soap and detergent "B" was a granular soap.

⁴Analysis obtained through the courtesy of Dr. J. K. G. Silvey, Department of Biology, North Texas State Teachers College, Denton, Texas.

⁵Analysis obtained through the courtesy of Dr. J. L. Carrico, Department of Chemistry, North Texas State Teachers College, Denton, Texas.

The soaps were tested for free alkali by a drop of phenolphthalein solution⁶ on a fresh-cut surface of detergent "A" and on a small amount of detergent "B." Detergent "A" was found to be a neutral soap and detergent "B" to contain free alkali.

A stock solution⁷ of each soap was made by adding one pound of soap to a gallon of water.

A suds two inches high was used, as "too much or too little soap does not wash satisfactorily."⁸

It was found that one-third cup of stock solution of each detergent to fourteen gallons of water was necessary to make the required suds.

The temperature used for the wash water and the first rinse water was that suggested by Carse and Jeffryes⁹ for colored cotton materials which ranged from 115° to 118° F. (46° to 47.5° C.). Table 8 in the Appendix shows these ranges in temperature.

The fabrics were agitated in the washing machine for ten minutes,¹⁰ then run through the machine wringer into the first rinse water. The rinsing was done by hand by dipping the samples up and down in the water several times; then they were run through the wringer into the second and

⁶Phelps, op. cit., p. 69.

⁷Woven Textile Fabrics, Testing and Reporting, third edition, Commercial Standard CS59-41, 17.

⁸Edith Carse and Helen Jeffryes, Laundry Equipment and Methods, p.12.

⁹Ibid., p. 14.

¹⁰Ibid., p. 13.

third rinses of tap water, respectively, with temperatures ranging from 68° to 75° F. (20.5° to 24° C.).

The samples were next rolled in a towel for thirty minutes to absorb a part of the water, then hung in a darkened room with fresh circulating air to dry. This was to prevent fading from light while drying.

When the samples taken out after the first, tenth, and twentieth washings had dried to a stage comparable in moisture content to that acquired by sprinkling, they were ironed with an automatic electric iron with the heat control set on "cotton." The test samples were ironed on the wrong side with the colored specimen on top of the bleached cotton¹¹ and with the right side of the fabric next to the white cloth.

The fading of the samples was compared and rated by two home economics teachers and one student who were accustomed to working with fabrics and colors. In making the comparison, the test samples were held parallel to each other and viewed at the same angle by daylight from north windows on a sunny day.

¹¹Committee D-13, op. cit., p. 86.

CHAPTER III

DISCUSSION OF RESULTS

As stated in the procedure, sixteen percales chosen for a variety of colors were purchased and tested for comparative colorfastness to washing under home conditions. An attempt made to secure similar colors carrying the labels "Guaranteed Fast Color" and "Fast to Washing" resulted, as shown in Table 1, in nine samples ranging in cost from twenty-five to thirty cents per yard and seven costing thirty-five cents per yard; these are average prices for a good quality of percale.

In comparing the data of Tables 2 and 3, one may see that five of the samples (1, 3, 7, 9, and 11 -- see Appendix) labeled "Fast to Washing" showed neither observable color change nor staining of the white cloth, while only two of the eight samples (2 and 6) labeled "Guaranteed Fast Color" showed neither observable color change nor staining of the white cloth upon being washed in detergent "A," a popular brand of a neutral soap. Three samples (5, 13, and 15) labeled "Fast to Washing" and six samples (4, 8, 10, 12, 14, and 16) labeled "Guaranteed Fast Color"

TABLE 2

THE DEGREE TO WHICH EACH TYPE OF FADING WAS EVIDENT IN EACH SAMPLE LABELED "FAST TO WASHING" IN THE FIRST, TENTH, AND TWENTIETH WASHINGS WHEN USING DETERGENT A

Type of Fading	First Wash	Tenth Wash	Twentieth Wash
Sample 1			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	No observable staining.	No observable staining.	No observable staining.
Sample 3			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	No observable staining.	No observable staining.	No observable staining.
Sample 5			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	Slight staining.	No further staining.	No further staining.
Sample 7			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	No observable staining.	No observable staining.	No observable staining.

TABLE 2 -- Continued

Type of Fading	First Wash	Tenth Wash	Twentieth Wash
Sample 9			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	No observable staining.	No observable staining.	No observable staining.
Sample 11			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	No observable staining.	No observable staining.	No observable staining.
Sample 13			
Color change.	No observable change.	Slight change.	No further change.
Staining.....	No observable staining.	No observable staining.	No observable staining.
Sample 15			
Color change.	Slight change.	No further change.	No further change.
Staining.....	Slight staining.	No further staining.	No further staining.

TABLE 3

THE DEGREE TO WHICH EACH TYPE OF FADING WAS EVIDENT IN EACH SAMPLE LABELED "GUARANTEED FAST COLOR" IN THE FIRST, TENTH, AND TWENTIETH WASHINGS WHEN USING DETERGENT A

Type of Fading	First Wash	Tenth Wash	Twentieth Wash
Sample 2			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	No observable staining.	No observable staining.	No observable staining.
Sample 4			
Color change.	No observable change.	Slight change.	No further change.
Staining.....	Slight staining.	No further staining.	No further staining.
Sample 6			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	No observable staining.	No observable staining.	No observable staining.
Sample 8			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	Slight staining.	No further staining.	No further staining.

TABLE 3 -- Continued

Type of Fading	First Wash	Tenth Wash	Twentieth Wash
Sample 10			
Color change. Staining.....	Slight change. No observable staining.	Continued change. No observable staining.	No further change. No observable staining.
Sample 12			
Color change. Staining.....	Slight change. No observable staining.	Continued change. No observable staining.	No further change. No observable staining.
Sample 14			
Color change. Staining.....	Slight change. No observable staining.	Continued change. No observable staining.	No further change. No observable staining.
Sample 16			
Color change. Staining.....	No observable change. Slight staining.	Slight change. No further staining.	No further change. No further staining.

which showed either type of fading, showed it by the end of the tenth wash. From these results the conclusion could be drawn that the "Fast to Washing" label is a better indication of colorfastness to washing with detergent "A," a neutral soap, than is the label, "Guaranteed Fast Color."

A similar conclusion can be drawn from a comparison of the data in Tables 4 and 5, where samples from the same percales were washed with detergent "B," a soap containing free alkali. Three of the samples (3, 7, and 11) labeled "Fast to Washing" showed neither type of fading, while all of the samples labeled "Guaranteed Fast Color" showed either one or the other type of fading. Two samples (1 and 9) in Table 4 showed the first color change (which was slight) in the twentieth wash. This was probably due to continued washing with detergent "B," a soap containing free alkali. Two samples (5 and 13) showed slight changes at the end of the tenth wash.

The data in Tables 2, 3, 4, and 5 also confirm the study reported by Pauline Beery Mack,² "where more than one laundering is indicated as desirable if proper predictions are to be made concerning the performance of the fabric in laundering during use." In addition, the present study seems to indicate that not more than ten washings would be necessary to give such prediction.

²Pauline Beery Mack, "Colorfastness of Women's and Children's Wearing Apparel Fabrics," Journal of Home Economics, XXXIV (1942), 49.

TABLE 4

THE DEGREE TO WHICH EACH TYPE OF FADING WAS EVIDENT IN EACH SAMPLE LABELED "FAST TO WASHING" IN THE FIRST, TENTH, AND TWENTIETH WASHINGS WHEN USING DETERGENT B

Type of Fading	First Wash	Tenth Wash	Twentieth Wash
Sample 1			
Color change.	No observable change.	No observable change.	Slight change.
Staining.....	No observable change.	No observable change.	No observable change.
Sample 3			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	No observable staining.	No observable staining.	No observable staining.
Sample 5			
Color change.	No observable change.	Slight change.	No further change.
Staining.....	Slight staining.	Continued staining.	No further staining.
Sample 7			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	No observable staining.	No observable staining.	No observable staining.

TABLE 4 -- Continued

Type of Fading	First Wash	Tenth Wash	Twentieth Wash
Sample 9			
Color change. Staining.....	No observable change. No observable staining.	No observable change. No observable staining.	Slight change. No observable staining.
Sample 11			
Color change. Staining.....	No observable change. No observable staining.	No observable change. No observable staining.	No observable change. No observable staining.
Sample 13			
Color change. Staining.....	No observable change. No observable staining.	Slight change. No observable staining.	No further change. No observable staining.
Sample 15			
Color change. Staining.....	Slight change. Slight staining.	No further change. No further staining.	No further change. No further staining.

TABLE 5

THE DEGREE TO WHICH EACH TYPE OF FADING WAS EVIDENT IN EACH SAMPLE LABELED "GUARANTEED FAST COLOR" IN THE FIRST, TENTH, AND TWENTIETH WASHINGS WHEN USING DETERGENT B

Type of Fading	First Wash	Tenth Wash	Twentieth Wash
Sample 2			
Color change.	No observable change.	Slight change.	No further change.
Staining.....	No observable staining.	No observable staining.	No observable staining.
Sample 4			
Color change.	No observable change.	Slight change.	No further change.
Staining.....	Slight staining.	No further staining.	No further staining.
Sample 6			
Color change.	Slight change.	No further change.	No further change.
Staining.....	No observable staining.	No observable staining.	No observable staining.
Sample 8			
Color change.	No observable change.	No observable change.	No observable change.
Staining.....	Severe staining.	No further staining.	No further staining.

TABLE 5 -- Continued

Type of Fading	First Wash	Tenth Wash	Twentieth Wash
Sample 10			
Color change. Staining.....	Slight change. No observable staining.	Continued change. No observable staining.	No further change. No observable staining.
Sample 12			
Color change. Staining.....	Slight change. No observable staining.	Continued change. No observable staining.	Continued change. No observable staining.
Sample 14			
Color change. Staining.....	Slight change. No observable staining.	Continued change. No observable staining.	No further change. No observable staining.
Sample 16			
Color change. Staining.....	Slight change. Severe staining.	Continued change. No further staining.	No further change. No further staining.

It is interesting to note, too, that none of these fabrics faded enough to cause them to be discarded even after twenty washings. This was true of fabrics bearing either label and washed in either type of detergent, thus indicating that while the samples labeled "Fast to Washing" showed less change of color than those labeled "Guaranteed Fast Color," both are relatively good predictors of change of color in home washing.

This statement, however, is not true when applied to the type of fading commonly known as bleeding or staining which is shown by staining light material in contact with it (see plates in Appendix). Two samples in Table 2 (5 and 15) labeled "Fast to Washing" showed only faint staining of the white muslin to which they were stitched when washed with detergent "A" in the first wash and none thereafter. In Table 4 both of these showed staining after the first wash when washed with detergent "B," and sample 5 showed continued staining after the tenth wash. Neither showed staining in the twentieth wash.

Results with samples bearing labels "Guaranteed Fast Color" showed, as indicated in Table 3, that three samples (4, 8, and 16) stained slightly in the first wash the white muslin to which they were sewed, but continued to stain no further; while with detergent "B" these same samples showed staining in the first wash, two of them showing severe staining.

Data given in Tables 2, 3, 4, and 5 indicate but slight difference in change of color between a neutral detergent and one containing free alkali, but the greatest degree of difference is in the degree of staining caused by the detergent containing free alkali. This would lead to a conclusion that alkali will affect the color in fabrics,³ and that, of the two most popular detergents used in this locality, detergent "A" is preferable to detergent "B" in the degree to which it affects colorfastness.

No analysis of the type of dye used on the samples was made, so no comparison was made as to the degree of fading in the different colors found in the samples.

Results of washing swatches of "Cotton Standards for Fastness to Washing," obtained from the American Association of Textile Chemists and Colorists, with the test samples using detergent "A" are shown in Table 6. Standard sample C. W. 2, which is supposed to stand home washing or commercial laundering without fading if the washing treatment is carried out at a temperature below 120° F. with a neutral soap, showed slight change of color in the tenth and twentieth washes and also severely stained the white muslin to which it was sewed in all of the washes (see Plate 17).

³L. Ray Balderston, Laundering, p. 105.

TABLE 6

THE DEGREE TO WHICH EACH TYPE OF FADING WAS EVIDENT
IN EACH STANDARD SAMPLE IN THE FIRST, TENTH, AND
TWENTIETH WASHINGS WHEN USING DETERGENT A

Type of Fading	First Wash	Tenth Wash	Twentieth Wash
Sample C. W. 2			
Color change. Staining.....	No observable change. Severe staining.	Slight change. Continued staining.	Continued change. Continued staining.
Sample C. W. 3			
Color change. Staining.....	No observable change. No observable staining.	No observable change. No observable staining.	Slight change. No observable staining.
Sample C. W. 4			
Color change. Staining.....	No observable change. No observable staining.	Slight change. No observable staining.	No further change. No observable staining.

Standard sample C. W. 3, which represents an excellent degree of fastness when no bleach is used and is supposed to stand repeated washing treatments at high temperatures without fading either in home or commercial laundering, showed a slight change in color in the twentieth wash, but

no staining of the white cloth in any of the washes.

Standard sample C. W. 4, which represents the highest degree of fastness and is not supposed to change color or to stain white cotton, showed slight color change in the tenth wash but no further change in the twentieth wash when washed with detergent "A," a neutral soap. There was no observable staining during the twenty washes by this sample.

Table 7 shows that the fading of the standard samples washed with detergent "B" coincided with the fading of the standard samples washed in detergent "A" with one exception, that being standard sample C. W. 2, which showed color change in the first wash instead of in the tenth wash, and the degree of staining with this sample was also greater with detergent "B," a soap containing free alkali.

A comparison of the data in Tables 2, 3, 4, and 5 with those in Tables 6 and 7 would lead to the conclusion that the test samples compare favorably with standard sample C. W. 4, which represents the highest degree of colorfastness. Only two samples, both labeled "Guaranteed Fast Color," faded as much as did standard sample C. W. 2. Colors of this class³ will stand home washing or commercial laundering if the washing treatment is carried out at a temperature below 120° F. with a neutral soap only.⁴

³Quoted from the card on which "Cotton Standards for Fastness to Washing" were attached.

⁴Committee D-13, op. cit., p. 86.

TABLE 7

THE DEGREE TO WHICH EACH TYPE OF FADING WAS EVIDENT
IN EACH STANDARD SAMPLE IN THE FIRST, TENTH, AND
TWENTIETH WASHINGS WHEN USING DETERGENT B

Type of Fading	First Wash	Tenth Wash	Twentieth Wash
Sample C. W. 2			
Color change.	Slight change.	Continued change.	Continued change.
Staining.....	Severe staining.	Continued staining.	Continued staining.
Sample C. W. 3			
Color change.	No observable change.	No observable change.	Slight change.
Staining.....	No observable staining.	No observable staining.	No observable staining.
Sample C. W. 4			
Color change.	No observable change.	Slight change.	No further change.
Staining.....	No observable staining.	No observable staining.	No observable staining.

Eleven of the samples faded no more than standard sample C. W. 3. "Colors of this type will stand repeated washing treatments at high temperatures either in home or commercial laundering when chlorine is not used in the

washing treatment."⁵

Three of the sixteen samples, all labeled "Fast to Washing," showed neither color change nor staining during the twenty washes, thus fading even less than the standard sample C. W. 4, which represents the highest degree of colorfastness.

All of the test samples which stained the white muslin with either detergent did so in the first wash, which would indicate that only one washing is necessary to determine whether a color will "bleed" or stain in home washing.

Under the conditions of this study samples washed with a neutral soap showed less fading than those washed with a soap containing free alkali; however, the difference in the opinion of the judges was slight.

The label "Fast to Washing" seemed to indicate a higher performance of colorfastness to washing with both detergents than the "Guaranteed Fast Color" label.

This study indicates that all of the sixteen percales, irrespective of the wording of the label, would stand repeated washings at temperatures ranging from 115° to 118° F. (46.1 to 47.7° C.) without serious change of color.

These indications from the tests point to other

⁵Quoted from the card on which "Cotton Standards for Fastness to Washing" were attached.

influencing factors in addition to actual washing or the use of soap, water, and a medium temperature which operate to produce the fading of cotton fabrics in home washing. This finding agrees with the Schaenzer study⁶ made in 1937.

⁶Teresa M. Schaenzer and Rose A. Hardy, "A Yard of Material," Journal of Home Economics, XXIX (1937), 17.

CHAPTER IV

SUMMARY

1. Sixteen percales, eight bearing the label "Fast to Washing" and eight bearing the label "Guaranteed Fast Color," were purchased to test for colorfastness to washing, under home conditions, using the two most popular types of detergents sold in this community.

2. The percales labeled "Fast to Washing" were more resistant to all types of fading from washing, under home conditions, than were those labeled "Guaranteed Fast Color."

3. None of the samples faded sufficiently to cause a garment made of them to be discarded.

4. Detergent "A," a neutral soap, seemed to be a better type of detergent to use when washing percales than detergent "B," which contained free alkali.

5. All of the percales tested stood repeated washings at fairly high temperatures without fading.

6. More than one washing, but not more than ten washings, are necessary to determine whether a fabric will fade when washed.

APPENDIX

TABLE 8

DEGREES OF TEMPERATURE (FAHRENHEIT)* OF WASH AND RINSE
WATERS WHEN USING EACH DETERGENT

Wash Number	Detergent A			Detergent B		
	Wash	First Rinse	Second and Third Rinses	Wash	First Rinse	Second and Third Rinses
1...	115	116	73	115	115	73
2...	117	115	73	115	116	73
3...	115	117	75	116	115	75
4...	118	115	71	118	115	71
5...	117	115	71	115	116	71
6...	116	116	73	115	115	73
7...	118	118	69	116	115	69
8...	115	115	69	115	116	69
9...	117	115	73	115	115	73
10...	117	115	70	117	115	70
11...	115	115	70	115	117	70
12...	117	115	74	117	115	74
13...	115	117	75	117	118	75
14...	118	115	69	117	115	69
15...	116	116	70	115	115	70
16...	118	115	72	117	117	72
17...	115	116	73	115	117	73
18...	116	115	70	116	115	70
19...	115	115	73	117	115	73
20...	117	116	75	115	116	75

*To convert to Centigrade, subtract 32° and divide by 1.8.

PLATE 1



Fig. 1.--Sample 1 (labeled "Fast to Washing") before washing.



Fig. 5.--Sample 2 (labeled "Guaranteed Fast Color") before washing.



Fig. 2.--Sample 1 after first washing with detergent A.



Fig. 6.--Sample 2 after first washing with detergent A.



Fig. 3.--Sample 1 after tenth washing with detergent A.



Fig. 7.--Sample 2 after tenth washing with detergent A.



Fig. 4.--Sample 1 after twentieth washing with detergent A.



Fig. 8.--Sample 2 after twentieth washing with detergent A.

PLATE 2



Fig. 9.--Sample 1 (labeled "Fast to Washing") before washing.



Fig. 13.--Sample 2 (labeled "Guaranteed Fast Color") before washing.



Fig. 10.--Sample 1 after first washing with detergent B.



Fig. 14.--Sample 2 after first washing with detergent B.



Fig. 11.--Sample 1 after tenth washing with detergent B.



Fig. 15.--Sample 2 after tenth washing with detergent B.



Fig. 12.--Sample 1 after twentieth washing with detergent B.



Fig. 16.--Sample 2 after twentieth washing with detergent B.

PLATE 3



Fig. 17.--Sample 3 (labeled "Fast to Washing") before washing.



Fig. 21.--Sample 4 (labeled "Guaranteed Fast Color") before washing.



Fig. 18.--Sample 3 after first washing with detergent A.



Fig. 22.--Sample 4 after first washing with detergent A.



Fig. 19.--Sample 3 after tenth washing with detergent A.



Fig. 23.--Sample 4 after tenth washing with detergent A.



Fig. 20.--Sample 3 after twentieth washing with detergent A.



Fig. 24.--Sample 4 after twentieth washing with detergent A.

PLATE 4



Fig. 25.--Sample 3 (labeled "Fast to Washing") before washing.



Fig. 29.--Sample 4 (labeled "Guaranteed Fast Color") before washing.



Fig. 26.--Sample 3 after first washing with detergent B.



Fig. 30.--Sample 4 after first washing with detergent B.



Fig. 27.--Sample 3 after tenth washing with detergent B.



Fig. 31.--Sample 4 after tenth washing with detergent B.



Fig. 28.--Sample 3 after twentieth washing with detergent B.



Fig. 32.--Sample 4 after twentieth washing with detergent B.

PLATE 5

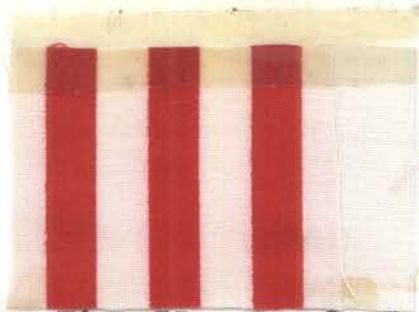


Fig. 33.--Sample 5 (labeled "Fast to Washing") before washing.



Fig. 34.--Sample 5 after first washing with detergent A.

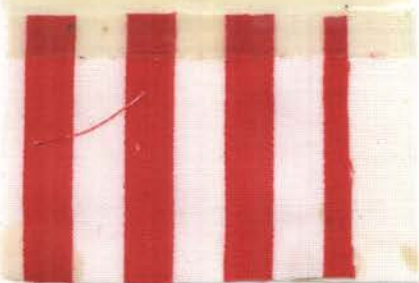


Fig. 35.--Sample 5 after tenth washing with detergent A.



Fig. 36.--Sample 5 after twentieth washing with detergent A.

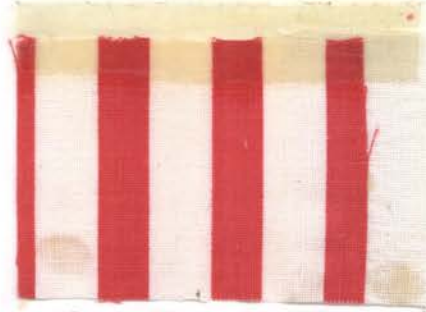


Fig. 37.--Sample 6 (labeled "Guaranteed Fast Color") before washing.



Fig. 38.--Sample 6 after first washing with detergent A.



Fig. 39.--Sample 6 after tenth washing with detergent A.



Fig. 40.--Sample 6 after twentieth washing with detergent A.

PLATE 6



Fig. 41.--Sample 5 (labeled "Fast to Washing") before washing.



Fig. 42.--Sample 5 after first washing with detergent B.

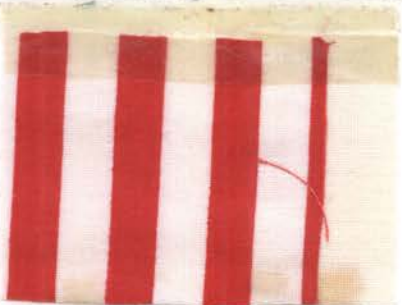


Fig. 43.--Sample 5 after tenth washing with detergent B.



Fig. 44.--Sample 5 after twentieth washing with detergent B.



Fig. 45.--Sample 6 (labeled "Guaranteed Fast Color") before washing.

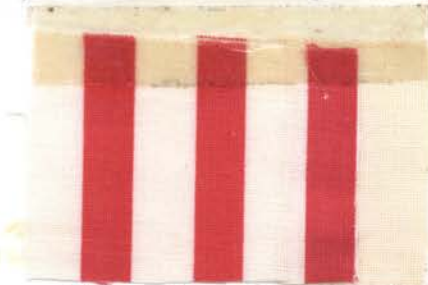


Fig. 46.--Sample 6 after first washing with detergent B.



Fig. 47.--Sample 6 after tenth washing with detergent B.



Fig. 48.--Sample 6 after twentieth washing with detergent B.

PLATE 7



Fig. 49.--Sample 7 (labeled "Fast to Washing") before washing.



Fig. 50.--Sample 7 after first washing with detergent A.



Fig. 51.--Sample 7 after tenth washing with detergent A.



Fig. 52.--Sample 7 after twentieth washing with detergent A.



Fig. 53.--Sample 8 (labeled "Guaranteed Fast Color") before washing.



Fig. 54.--Sample 8 after first washing with detergent A.



Fig. 55.--Sample 8 after tenth washing with detergent A.



Fig. 56.--Sample 8 after twentieth washing with detergent A.

PLATE 8



Fig. 57.--Sample 7 (labeled "Fast to Washing") before washing.



Fig. 58.--Sample 7 after first washing with detergent B.



Fig. 59.--Sample 7 after tenth washing with detergent B.



Fig. 60.--Sample 7 after twentieth washing with detergent B.



Fig. 61.--Sample 8 (labeled "Guaranteed Fast Color") before washing.



Fig. 62.--Sample 8 after first washing with detergent B.



Fig. 63.--Sample 8 after tenth washing with detergent B.



Fig. 64.--Sample 8 after twentieth washing with detergent B.

PLATE 9



Fig. 65.--Sample 9 (labeled "Fast to Washing") before washing.



Fig. 69.--Sample 10 (labeled "Guaranteed Fast Color") before washing.



Fig. 66.--Sample 9 after first washing with detergent A.



Fig. 70.--Sample 10 after first washing with detergent A.



Fig. 67.--Sample 9 after tenth washing with detergent A.

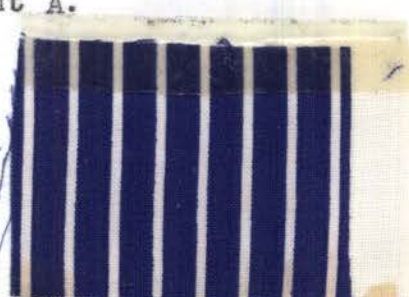


Fig. 71.--Sample 10 after tenth washing with detergent A.



Fig. 68.--Sample 9 after twentieth washing with detergent A.



Fig. 72.--Sample 10 after twentieth washing with detergent A.

PLATE 10



Fig. 73.--Sample 9 (labeled "Fast to Washing") before washing.



Fig. 77.--Sample 10 (labeled "Guaranteed Fast Color") before washing.



Fig. 74.--Sample 9 after first washing with detergent B.



Fig. 78.--Sample 10 after first washing with detergent B.



Fig. 75.--Sample 9 after tenth washing with detergent B.



Fig. 79.--Sample 10 after tenth washing with detergent B.



Fig. 76.--Sample 9 after twentieth washing with detergent B.

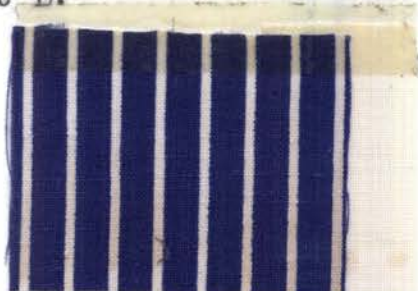


Fig. 80.--Sample 10 after twentieth washing with detergent B.

PLATE 11



Fig. 81.--Sample 11 (labeled "Fast to Washing") before washing.



Fig. 82.--Sample 11 after first washing with detergent A.



Fig. 83.--Sample 11 after tenth washing with detergent A.



Fig. 84.--Sample 11 after twentieth washing with detergent A.



Fig. 85.--Sample 12 (labeled "Guaranteed Fast Color") before washing.



Fig. 86.--Sample 12 after first washing with detergent A.



Fig. 87.--Sample 12 after tenth washing with detergent A.



Fig. 88.--Sample 12 after twentieth washing with detergent A.

PLATE 12



Fig. 89.--Sample 11 (labeled "Fast to Washing") before washing.



Fig. 90.--Sample 11 after first washing with detergent B.



Fig. 91.--Sample 11 after tenth washing with detergent B.



Fig. 92.--Sample 11 after twentieth washing with detergent B.



Fig. 93.--Sample 12 (labeled "Guaranteed Fast Color") before washing.



Fig. 94.--Sample 12 after first washing with detergent B.



Fig. 95.--Sample 12 after tenth washing with detergent B.



Fig. 96.--Sample 12 after twentieth washing with detergent B.

PLATE 13



Fig. 97.--Sample 13 (labeled "Fast to Washing") before washing.



Fig. 98.--Sample 13 after first washing with detergent A.



Fig. 99.--Sample 13 after tenth washing with detergent A.



Fig. 100.--Sample 13 after twentieth washing with detergent A.



Fig. 101.--Sample 14 (labeled "Guaranteed Fast Color") before washing.



Fig. 102.--Sample 14 after first washing with detergent A.



Fig. 103.--Sample 14 after tenth washing with detergent A.



Fig. 104.--Sample 14 after twentieth washing with detergent A.

PLATE 14



Fig. 105.--Sample 13 (labeled "Fast to Washing") before washing.



Fig. 106.--Sample 13 after first washing with detergent B.



Fig. 107.--Sample 13 after tenth washing with detergent B.



Fig. 108.--Sample 13 after twentieth washing with detergent B.



Fig. 109.--Sample 14 (labeled "Guaranteed Fast Color") before washing.



Fig. 110.--Sample 14 after first washing with detergent B.



Fig. 111.--Sample 14 after tenth washing with detergent B.



Fig. 112.--Sample 14 after twentieth washing with detergent B.

PLATE 15



Fig. 113.--Sample 15 (labeled "Fast to Washing") before washing.



Fig. 114.--Sample 15 after first washing with detergent A.



Fig. 115.--Sample 15 after tenth washing with detergent A.



Fig. 116.--Sample 15 after twentieth washing with detergent A.



Fig. 117.--Sample 16 (labeled "Guaranteed Fast Color") before washing.



Fig. 118.--Sample 16 after first washing with detergent A.

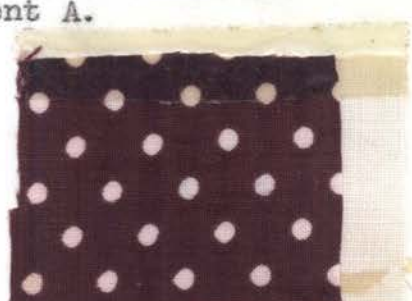


Fig. 119.--Sample 16 after tenth washing with detergent A.

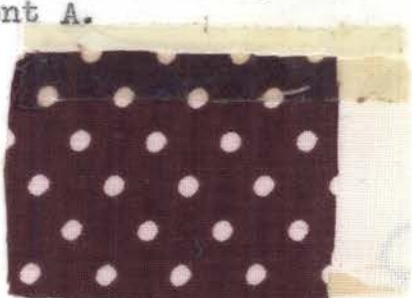


Fig. 120.--Sample 16 after twentieth washing with detergent A.

PLATE 16



Fig. 121.--Sample 15 (labeled "Fast to Washing") before washing.



Fig. 122.--Sample 15 after first washing with detergent B.



Fig. 123.--Sample 15 after tenth washing with detergent B.



Fig. 124.--Sample 15 after twentieth washing with detergent B.



Fig. 125.--Sample 16 (labeled "Guaranteed Fast Color") before washing.



Fig. 126.--Sample 16 after first washing with detergent B.



Fig. 127.--Sample 16 after tenth washing with detergent B.



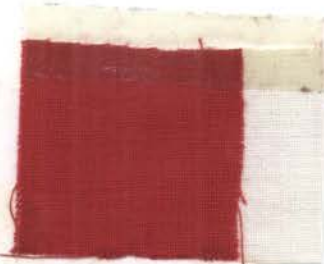
Fig. 128.--Sample 16 after twentieth washing with detergent B.

PLATE 17

C. W. 2

C. W. 3

C. W. 4



Standard samples before washing.



Standard samples after first washing with detergent A.



Standard samples after tenth washing with detergent A.



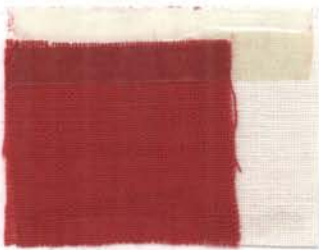
Standard samples after twentieth washing with detergent A.

PLATE 18

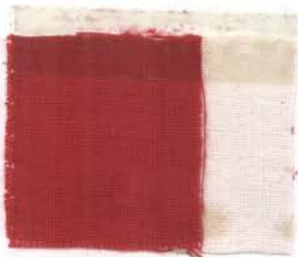
C. W. 2

C. W. 3

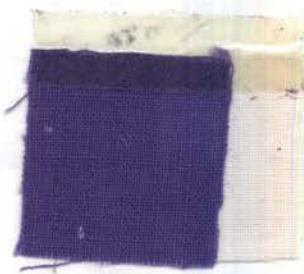
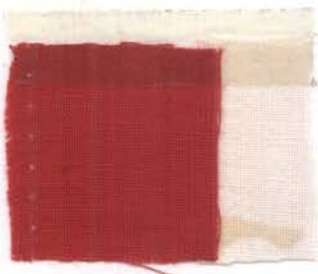
C. W. 4



Standard samples before washing.



Standard samples after first washing with detergent B.



Standard samples after tenth washing with detergent B.



Standard samples after twentieth washing with detergent B.

BIBLIOGRAPHY

- Adkins, Katie, "The Effect of Home and Commercial Laundering upon the Wearing Qualities of White Cotton Garments and Fabrics," Unpublished Master's Thesis, Department of Home Economics, University of Missouri, 1931.
- Balderston, L. Ray, Laundering, Philadelphia, L. R. Balderston, 1914.
- Bureau of Home Economics, How to Make Your Washing Machine Last Longer, Washington, Bureau of Home Economics.
- Carse, Edith, and Jeffryes, Helen, Laundry Equipment and Methods, Circular 49, Lincoln, College of Agriculture, University of Nebraska, 1934.
- Committee D-13, A. S. T. M. Standards on Textile Materials, Philadelphia, American Society for Testing, 1940.
- Davison, Suzanne, and Ginter, Della Eppel, "Tests on 'Unused' and 'Worn-out' Plain Weave Cotton Fabrics," Journal of Home Economics, XXIX (1937), 333-335.
- Edgerton, E. M., "Fastness Requirements of Printed Cottons," American Dyestuff Reporter, XXVII (1938), 321.
- Federal Trade Commission, Proposed Trade Practice Rules Relating to the Colorfastness of Textiles, Washington, Federal Trade Commission, 1942.
- Frankenberg, Gypsy B., and Hays, Margaret B., "An Analysis of 33 Qualities of Unbleached Muslin," Journal of Home Economics, XXXIV (1942), 737-741.
- Ginter, Adella Eppel, and Adkins, Katie, et al., "The Durability of Cotton Garments as Affected by Laundering and Wear," Journal of Home Economics, XXIX (1937), 326-332.
- Ginter, Adella Eppel, Shaddock, Margaret, et al., "The Effects of Laundry Methods on Cotton Fabrics," Journal of Home Economics, XXIX (1937), 319-326.

- Hays, Margaret B., "What We Learn from Serviceability Studies," Journal of Home Economics, XXXI (1939), 170-172.
- Hays, Margaret B., and Frankenberg, Gypsy B., "Physical Analysis of 31 Qualities of Outing Flannel," Journal of Home Economics, XXXIII (1941), 404-408.
- Heard, M. Earl, "Wartime Developments in Textiles and Clothing," Journal of Home Economics, XXXIV (1942), 427-432.
- Mack, Pauline Berry, "Effect of Home Laundry Methods upon the Breaking Strength of Unweighted and Weighted Silks," Journal of Home Economics, XXI (1929), 854-855.
- Mack, Pauline Beery, et al., "The Colorfastness of Certain Types of Dyes on Women's and Children's Wearing Apparel Fabrics," American Dyestuff Reporter, XXXI (1942), 607.
- Mack, Pauline Beery, et al., "Colorfastness of Women's and Children's Wearing-Apparel Fabrics," Journal of Home Economics, XXXIV (1942), 539-550.
- Morris, Esther Mary, "The Effect of Home and Commercial Laundering upon the Wearing Quality of White Cotton Fabrics," Unpublished Master's Thesis, Department of Home Economics, University of Missouri, 1929.
- Morrison, Bess Viemont, "Physical Characteristics of Slip Cover Fabrics as a Guide to Their Serviceability," Journal of Home Economics, XXXIII (1941), 661-667.
- Peet, Louise Jenison, and Sater, Lenore E., Household Equipment, New York, John Wiley and Sons, 1940.
- Phelps, Ethel M., A Laboratory Manual for Advanced Courses in Textiles, Minneapolis, Burgess-Rosenberry Company, 1928.
- Roberts, Jane A., "Effect of Home Laundry Methods as Measured by Degradation of Certain Fabrics," Unpublished Master's Thesis, Department of Home Economics, Iowa State College, 1938.
- Rogers, Ruth Elmquist, and Hays, Margaret B., "Evaluating the Serviceability of Fabrics," Journal of Home Economics, XXXIV (1942), 435.

- Saville, Dorothy, "The Relationships between Price and Certain Properties of Percale," Unpublished Master's Thesis, Department of Home Economics, Oklahoma Agricultural and Mechanical College.
- Schaenger, Teresa M., and Hardy, Rose A., "A Yard of Material," Journal of Home Economics, XXIX (1937), 16-18.
- Searl, Anne Brohel; Chapman, Esther Naomi; and Roseberry, Elizabeth Douglass, "Cooperative Project in Textiles Conducted by the Northeastern Experiment Stations," Journal of Home Economics, XXXI (1939), 177-184.
- Skinkle, John W., Textile Testing, New York, Chemical Publishing Company, 1940.
- Snyder, Edna B., and Winegar, Gladys, "The Effect of Home and Commercial Laundry Methods on Cotton Fabrics," Journal of Home Economics, XXV (1933), 488-490.
- Steckel, Frieda May, "The Effects of Certain Common Detergents Used in the Home Laundry upon Selected Cotton Fabrics," Unpublished Master's Thesis, Department of Home Economics, Kansas State College of Agriculture and Applied Science.
- Textile Groups, "Seek Workable Fastness Rules," Textile World, October, 1942, p. 77.
- Turnbull, Eve Elizabeth, and Supple, Mary G., "Effect of Washing Agents on Linen and Cotton Fabrics," Journal of Home Economics, XVII (1925), 382-387.
- United States Department of Commerce, Woven Textile Fabrics, Commercial Standard CS59-41, Washington, Government Printing Office, 1941.
- Viemont, Bess M., and Baker, Lillian, "The Effect of Certain Laundry Soaps on Selected Dress Gingham," Journal of Home Economics, XXI (1929), 278-282.
- White, Gladys R., "Physical Properties of Cotton Chambray and Covert Fabrics," Journal of Home Economics, XXXIV (1942), 42-50.