

FACULTY RESEARCH EDITION

OF

THE SAVANNAH STATE COLLEGE BULLETIN

Published by

THE SAVANNAH STATE COLLEGE

Volume 11, No. 2

Savannah, Georgia

October, 1957

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The Savannah State College Bulletin is published in October, December, February, March, April, and May by Savannah State College. Entered as second-class matter, December 16, 1947, at the Post Office at Savannah, Georgia under the Act of August 24, 1912.

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Serviceability and Suitability of Denim

by

Farnese Hughes Lumpkin

One of the greatest problems confronting the consumer in purchasing yard goods and ready-to-wear garments is shrinkage and colorfastness. Most of the garments and yard goods are preshrunk, but in spite of that some shrinkage and colorfastness are still observed. Investigations are still being done in that direction by such organizations as the American Society for Testing Materials, (ASTM) Committee D-13, and by others.

PROBLEM

Three samples of denim fabric were selected for test purposes. Each sample was approximately one yard square. The price per running yard ranged from \$0.59 to \$1.39. Tests were made on swatches or specimen of each fabric.

The three samples were selected and tested for serviceability and to determine which fabric was best suitable for such garments as casual suits, dresses, or play clothes. Each of the fabrics was tested according to the methods recommended by Commercial Standard CS59-44 to determine the following qualities: Dry breaking strength (pounds) warp and filling; wet breaking strength (pounds) warp and filling; shrinkage (percent) to dry cleaning, warp and filling; shrinkage (percent) to laundering, warp and filling; fastness of color to light; fastness of color to perspiration; fastness of color to dry cleaning; and fastness of color to laundering.

Other test methods and calculations were used to determine: Fiber content, W and F; price per square yard, width in inches, yarn structure, W and F; Thickness in inches; weight in ounces per square yard; change in strength (%); and method of coloring.

PROCEDURE

Each piece of fabric was laid out on a flat surface without pressing or tension and cut into swatches or specimen for shrinkage and breaking strength.

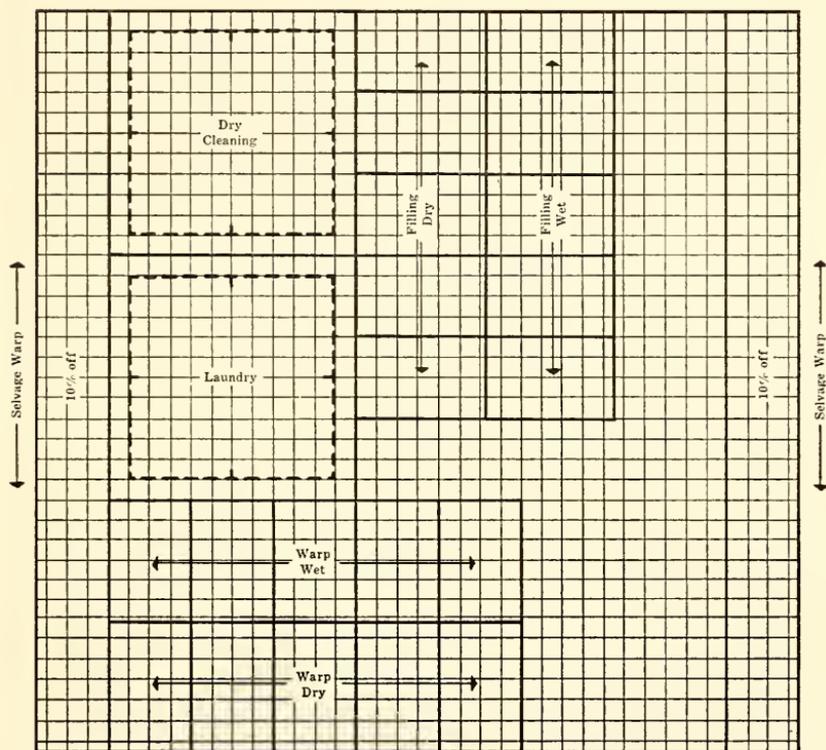
SHRINKAGE—Two specimen were cut, one for shrinkage in cleaning, dry, the other for laundering. The specimen were taken no nearer the selvage than one-tenth the width of the fabric. Each measured at least 12 by 12 inches. A 10-inch square whose sides were placed parallel with the warp and filling of the specimen was outlined on it with the aid of a rigid templet. The corners and mid-points

of each side of the square were marked with a fine thread sewed into the fabric. Other possible markings could have been indelible ink applied with a fine pen or by 1/16-inch holes punched in the fabric.

Cleaning, dry—The apparatus was filled approximately one-third with Stoddard Solvent to which was added 270 ml. of dry-cleaning soap. Time of first operation was 25 minutes, second operation was 5 minutes.

DIAGRAM FOR MARKING WOVEN FABRIC TO BE CUT INTO SWATCHES

Scale: 1 block = 1 inch



Laundering—The washing was carried out in a reversing wash wheel of the cylindrical type. The machine had a 20 or 24-inch wheel that took a load of about 3 pounds of dry wash. The soap solution was that of a good grade of laundry soap prepared into a stock solution.

The hand pressing method was used for both specimen.

BREAKING STRENGTH—Twenty specimen, each 4 inches wide and not less than 6¼ inches long were cut for this test. Ten of those specimen were cut with their long

sides parallel to the warp yarns (for warp breaking strength) and 10 specimen were cut with their long sides parallel to the filling yarns (for filling breaking strength) in such a manner that there were five pairs of specimen in each direction; each pair of which contained the same warp or filling yarns but no two pairs of which contained the same yarns (warp or filling). No specimen was taken nearer the selvage than one-tenth the width of the material.

Five specimen in each set, of which no two specimen contained the same yarns (warp or filling), were used for determining the breaking strength of the material under standard atmospheric conditions and the remaining specimen for determining the breaking strength of the material when wet.

A motor-driven pendulum machine was used. It was of such a capacity that when the specimen broke, the angle between the pendulum and the vertical was between 9° and 45°. The jaws through which the load was applied moved at a uniform rate of 12½ inches per minute.

The method used to determine the breaking strength of the specimen was the Grab Method.

COLORFASTNESS TO LIGHT—Five specimen were cut, each measured about 2½ by 3 inches, the longer dimension running in the direction of the warp, lengthwise of yarns. Each specimen included all of the colors in the design. A piece of the original specimen or specimen number 1 was saved for comparison with the tested swatches. Number 2 was exposed 10 hours, number 3—20 hours, number 4—30 hours and number 5—40 hours.

FASTNESS OF COLOR TO LIGHT

<i>Specimen Number</i>	<i>Hours of Exposure</i>	<i>Rating</i>
<i>Original</i>	<i>Not Exposed</i>	
2	10	Fair
3	20	Poor
4	30	Poor
5	40	Poor

Average—Poor

COLORFASTNESS TO PERSPIRATION—Two specimen of the fabric, approximately 2 by 4 inches, were cut so they could be rolled lengthwise and inserted in the glass tube—one for the acid test and one for the alkaline test.

One piece of composite test cloth of the same dimension as the specimen was used for each specimen tested.

Two solutions were used as follows:

ACID SOLUTION

- 10 g of sodium chloride
- 1 g of lactic acid, USP 85 percent
- 1 g of disodium orthophosphate anhydrous
- 1 liter was made up with distilled water

ALKALINE SOLUTION

- 10 g of sodium chloride
- 4 g of ammonium carbonate, USP
- 1 g of disodium orthophosphate anhydrous
- 1 liter was made up with distilled water

PRESENT STUDY

(Testing)

The different fabrics were tested according to: Textiles—Testing and Reporting (Fourth Edition) Commercial Standard CS59-44, U.S. Department of Commerce, National Bureau of Standards.

The three fabrics were of the same fiber content—cotton. Method of coloring—yarn dyed. Fabric number 1 had a special finish—flock print design. Fabric number 2 was a four color stripe—colors woven in by wrap yarns. Fabric number 3 was solid color. Fabric number 1 was of plain weave. Fabrics number 2 and 3 were of twill weave.

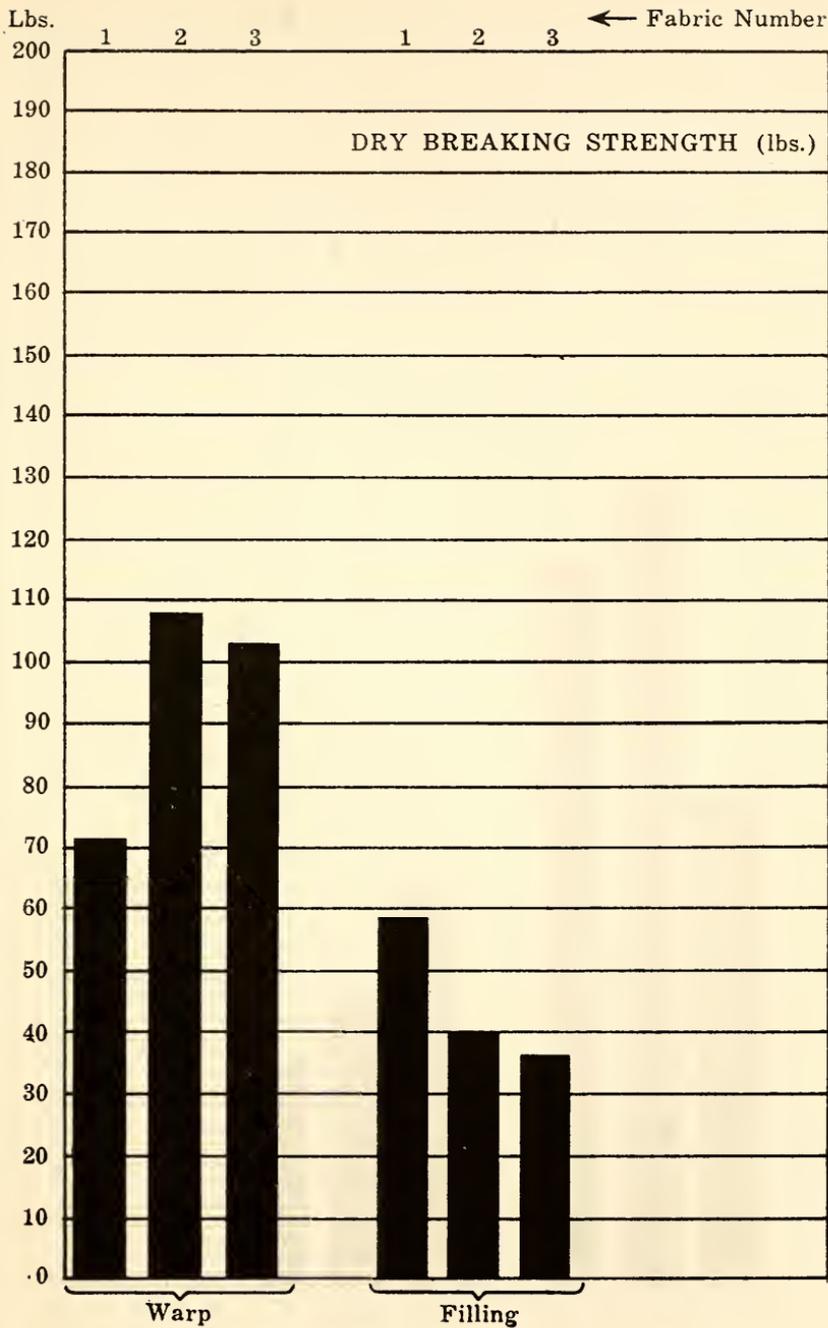
FABRIC NUMBER ONE—The breaking strength (wet and dry) of the warp yarns was less than that found in fabric two and three. The percent elongation (dry) for the warp and filling yarns were higher. The warp and filling yarns stretched in the dry cleaning process and shrunk in laundering. Color fastness to light was poor, laundering—fair, dry cleaning—good, perspiration—(acid) good, perspiration—(alkaline) fair.

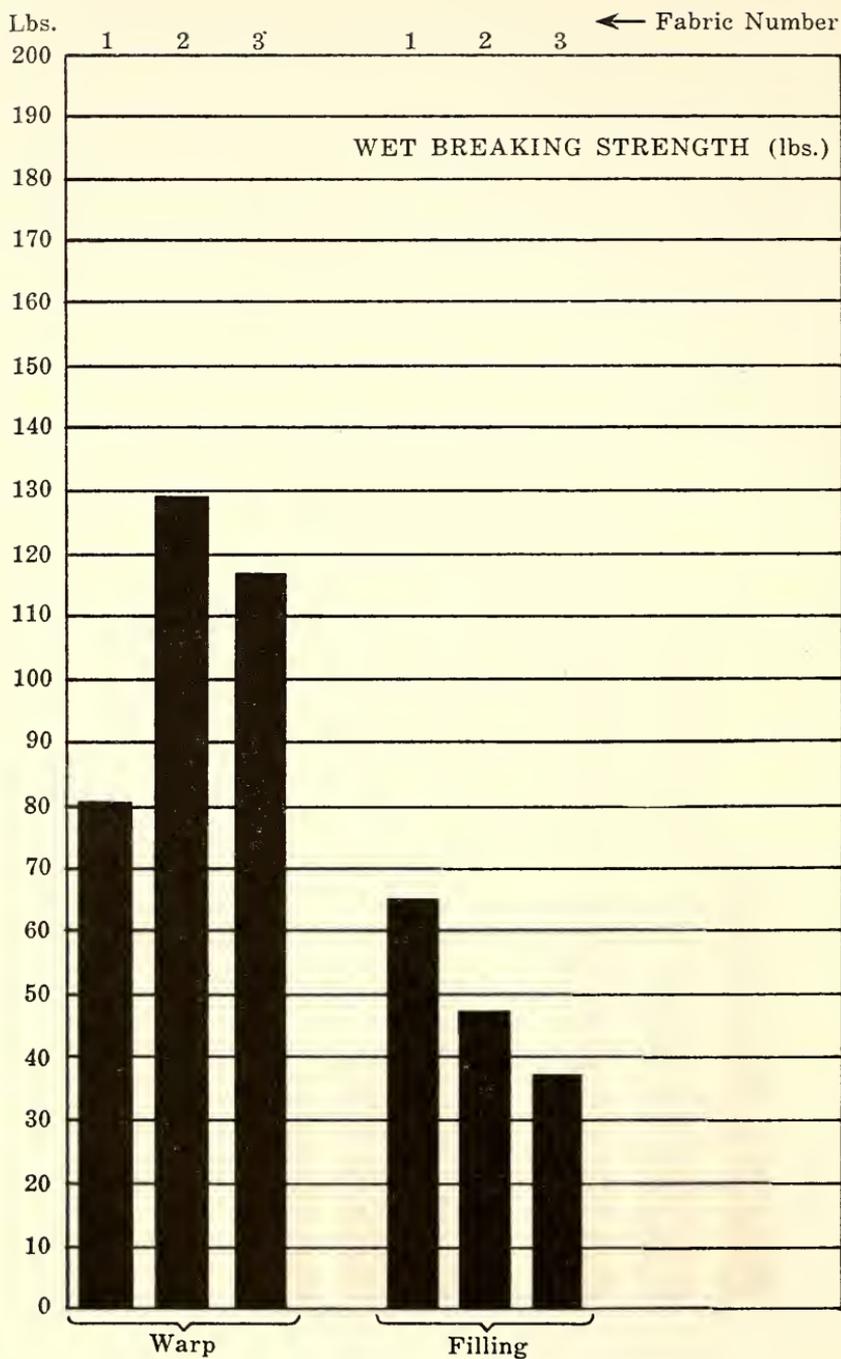
FABRIC NUMBER TWO—The breaking strength (wet and dry) of the warp yarns were higher in fabric number one and three. The percent elongation (wet) in the warp was higher than in fabrics one and three. The filling yarns in dry cleaning shrunk 1%. In the laundry process the filling yarns shrunk 2%. Color fastness to light was poor. A slight amount of bleeding was observed on the alkaline test to perspiration. Acid test—good.

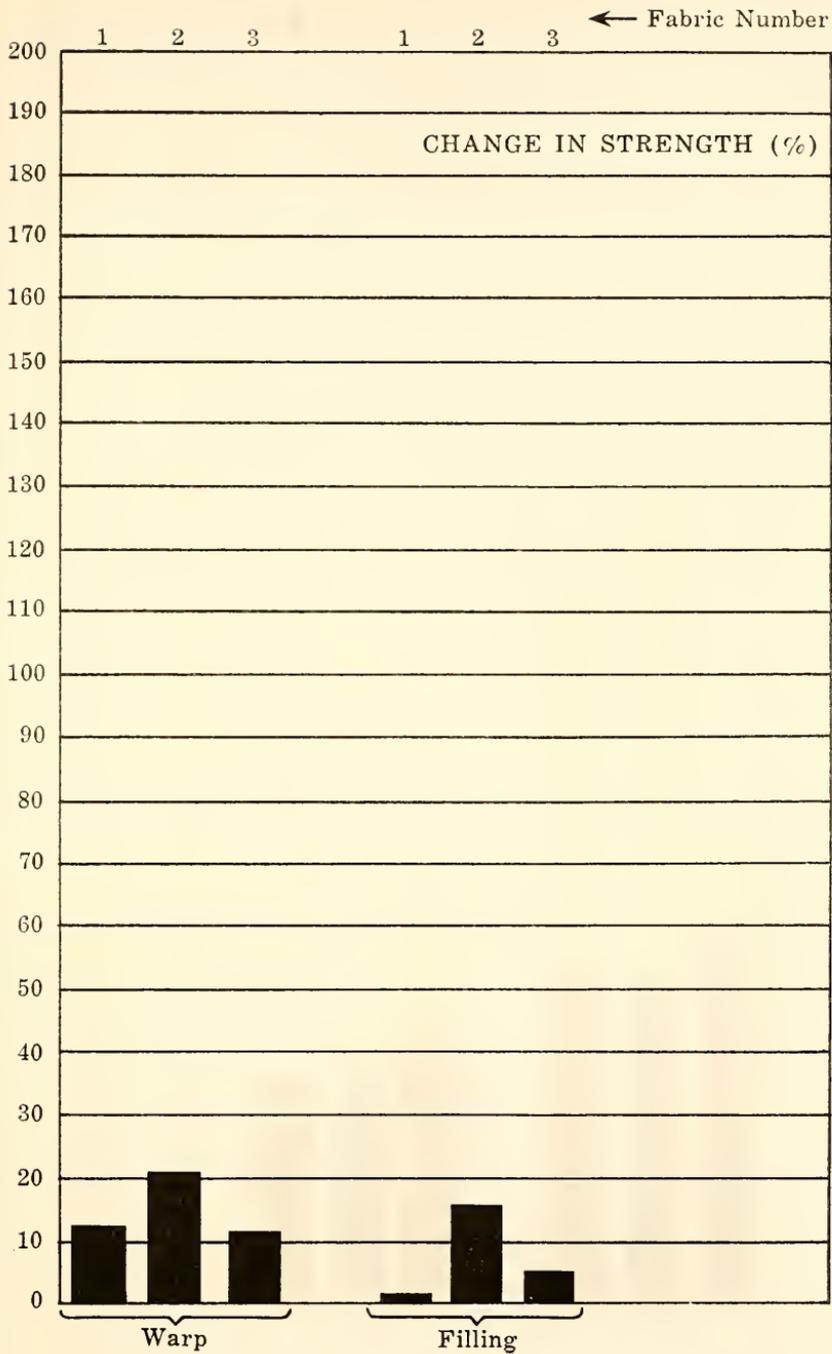
FABRIC NUMBER THREE—The breaking strength (wet and dry) of the filling yarns was less than that found in fabric one and two. The warp and filling yarns had a high percent shrinkage to laundry. Both warp and filling yarns stretched in the dry cleaning process. Perspiration (acid and alkaline) good.

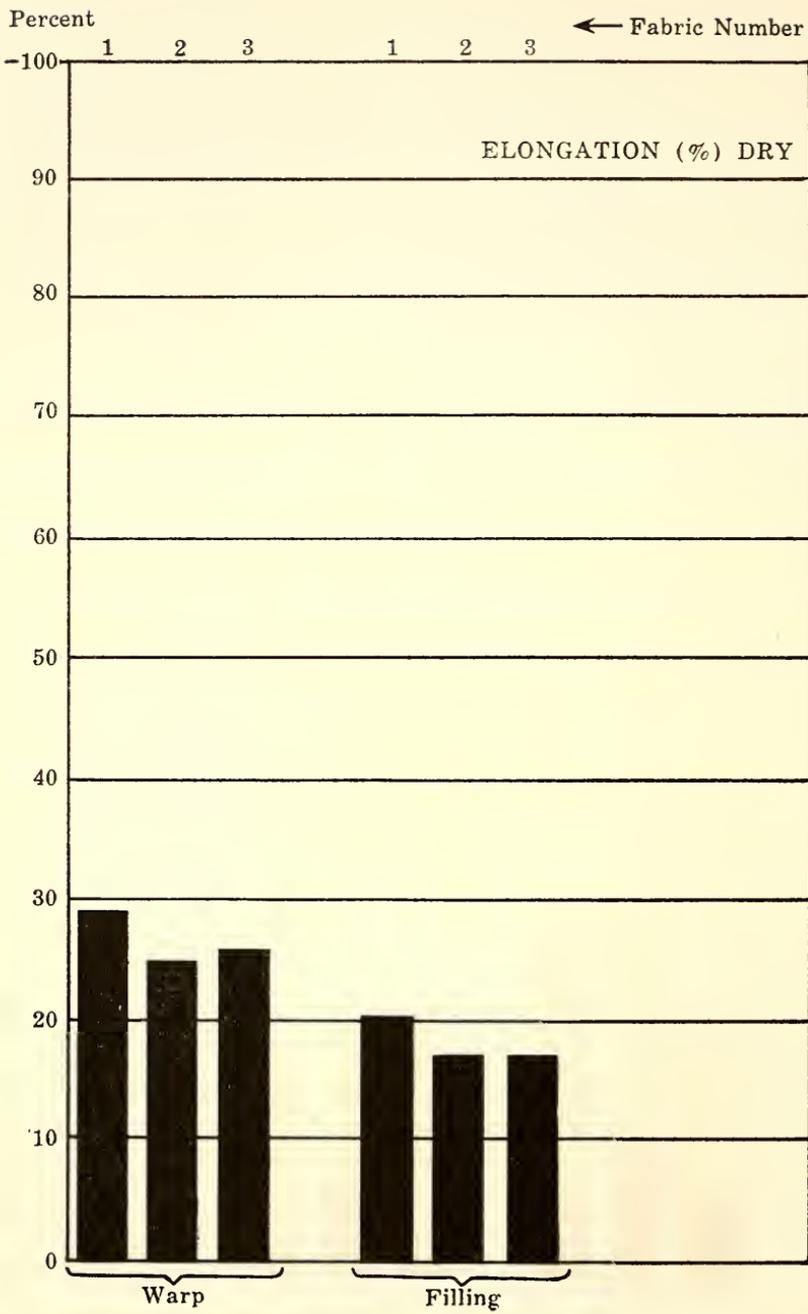
Fabric Number	1	2	3
Fabric	Denim	Denim	Denim
Price per running yard	\$ 1.39	\$ 0.59	\$ 0.59
Price per square yard	\$ 1.35	\$ 0.5883	\$ 0.57
Fiber Content W	Cotton	Cotton	Cotton
Fiber Content F	Cotton	Cotton	Cotton
Width in inches	37.44"	36.1"	37"
Yarn structure W	Simple Single	Simple Single	Simple Single
Yarn structure F	Simple Single	Simple Single	Simple Single
Fabric structure	Plain	Twill	Twill
Yarn count per inch W	68.4	47 1/5	62
Yarn count per inch F	56.8	50	44.1
Thickness in inches	.0166	.019	.020
Weight in oz. per sq. yd.	5.78	6.24	6.3
Dry breaking strength (lbs.) W	71	107.6	103.5
Dry breaking strength (lbs.) F	58.6	40.0	36
Wet breaking strength (lbs.) W	80.2	129.7	116.6
Wet breaking strength (lbs.) F	65.2	46.4	37.7

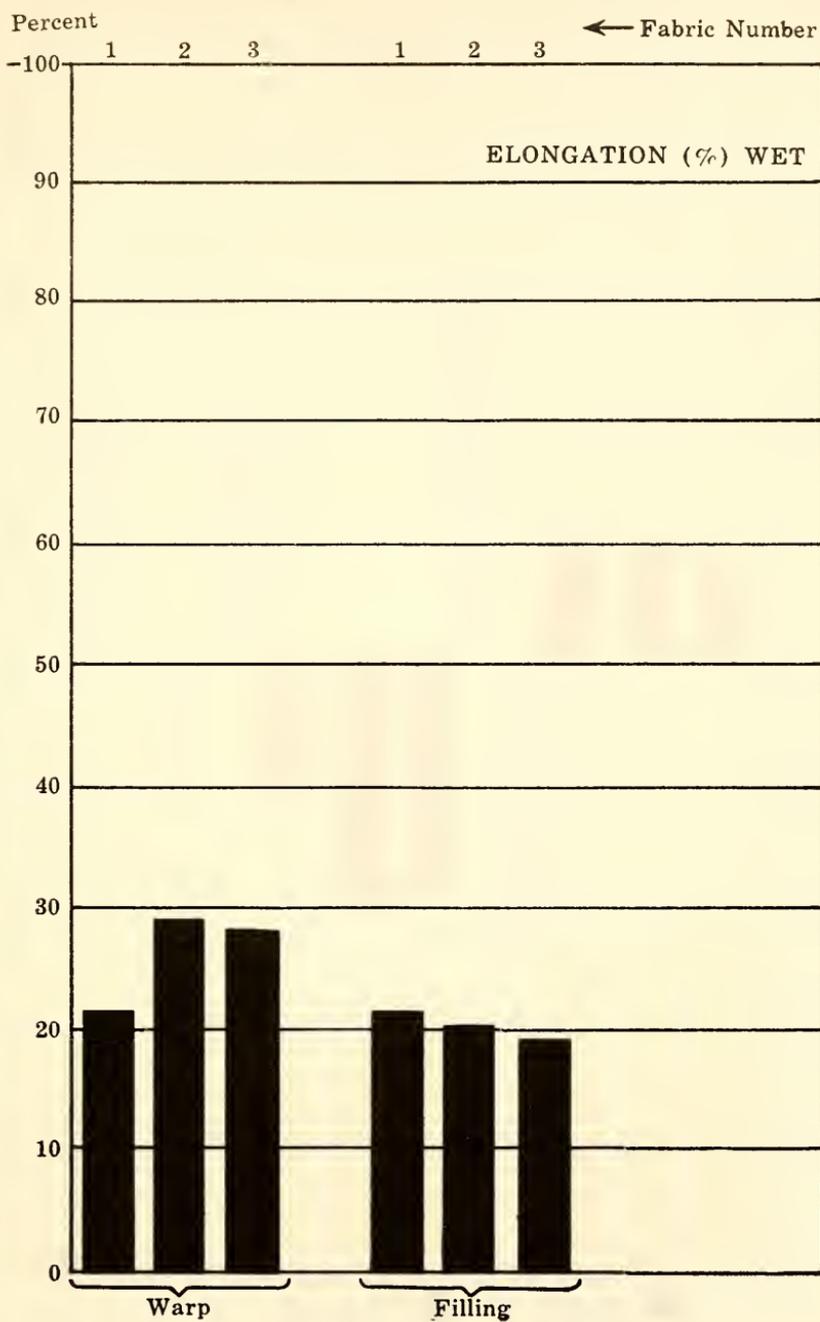
Fabric Number	1		2		3	
Change in strength (%) W	12.9		20.5		12.6	
Change in strength (%) F	1.1		1.6		4.7	
Elongation (%) dry W	29		25		25.6	
Elongation (%) dry F	20.3		17		17	
Elongation (%) wet W	22.4		28.6		26.5	
Elongation (%) wet F	23.5		20.6		19.5	
	Dry Cleaning	Laundry	Dry Cleaning	Laundry	Dry Cleaning	Laundry
Shrinkage (%) W	+ .1	-1.9	+ 1	-2	+ 1	-1.2
Shrinkage (%) F	+ .2	-1.4	-1	+ .3	+ .2	+ 2.5
Shrinkage (in. per yd.) W	+ .036	- .684	+ .36	- .72	+ .36	- .43
Shrinkage (in. per yd.) F	+ .072	- .504	+ .36	- .108	+ .072	- .9
Method of coloring	Yarn Dyed		Yarn Dyed		Yarn Dyed	
Fastness of color to light	Poor		Poor		Good	
to laundering	Fair		Good		Good	
to dry cleaning	Good		Good		Good	
Special finishes	Flock Print		None		None	
Perspiration (Acid test)	Good		Good		Good	
Perspiration (Alkaline test)	Fair		Fair		Good	

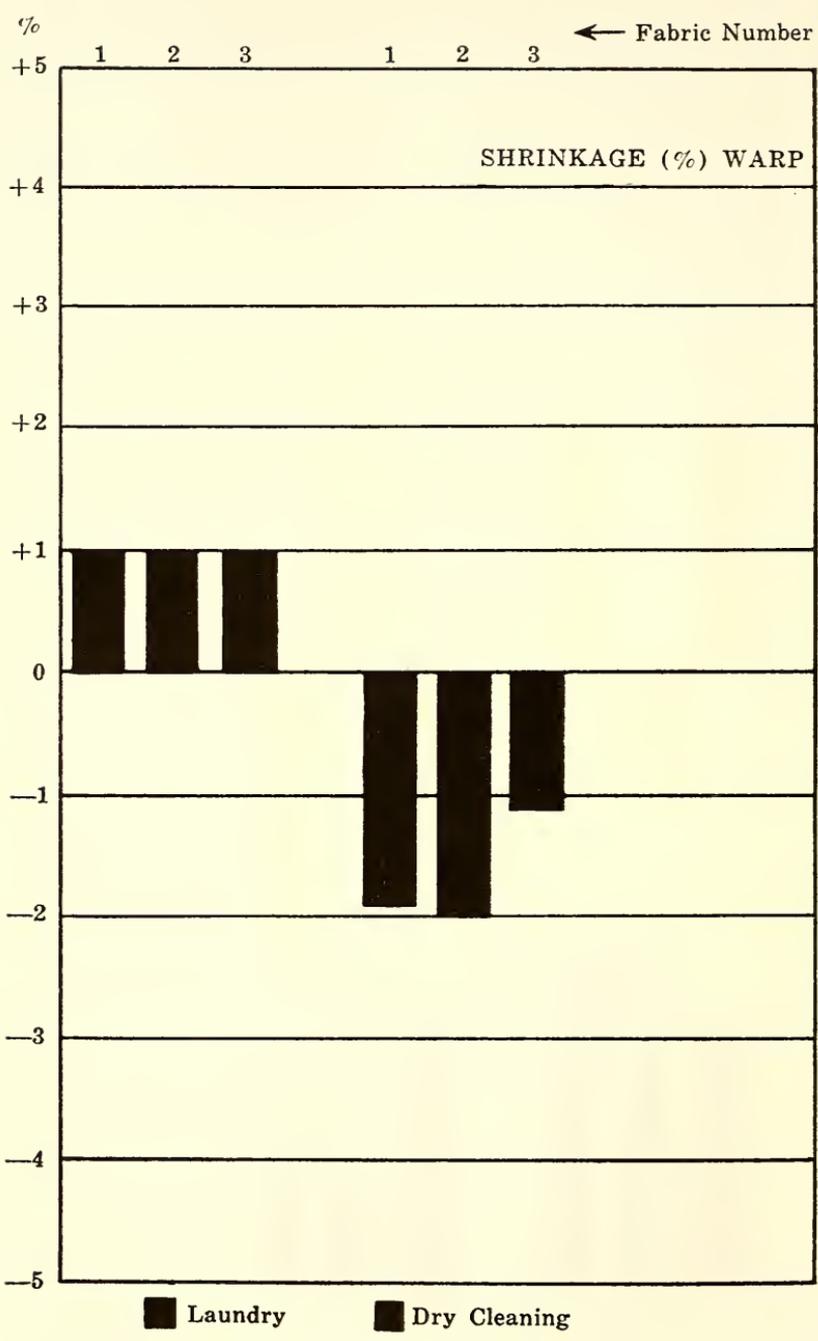


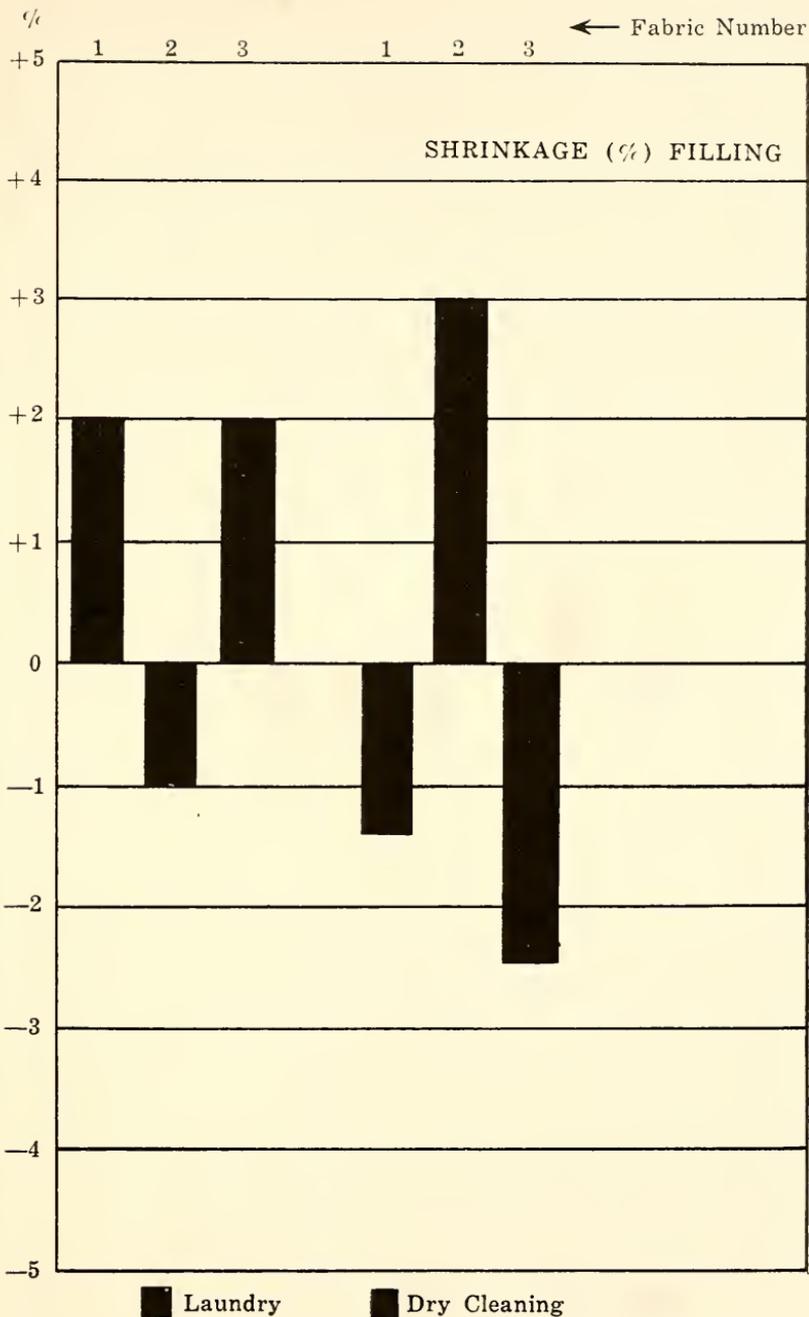






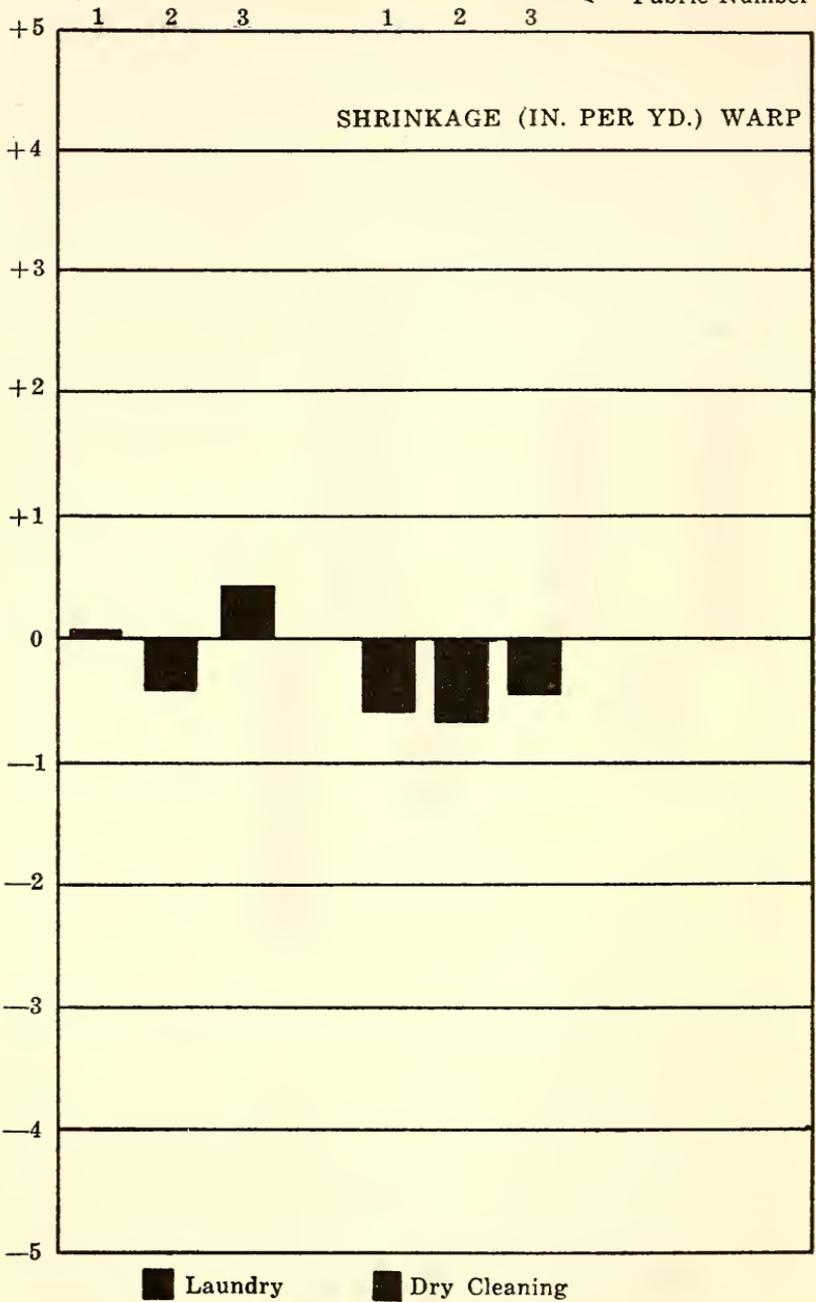




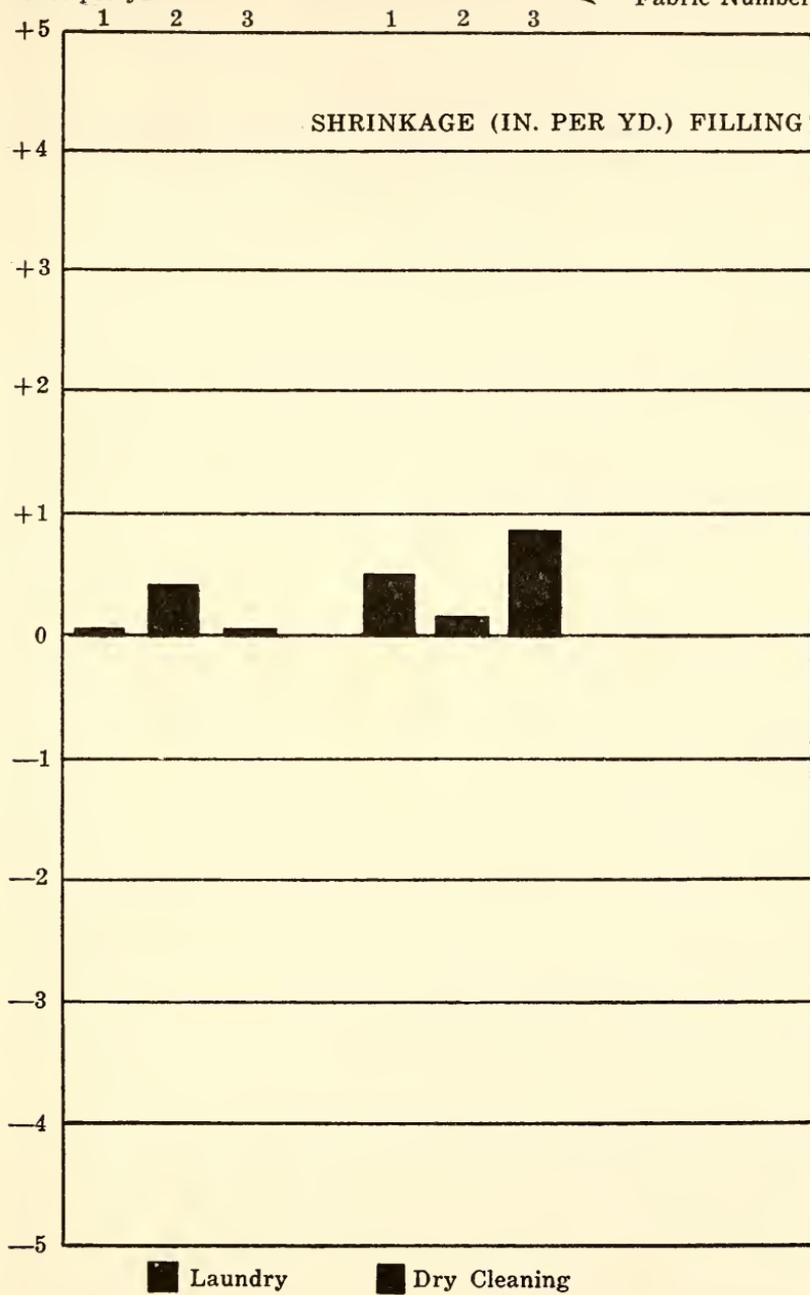


Inches per yd.

← Fabric Number



Inches per yd. ← Fabric Number



SUMMARY

Laundering caused the three cotton denim fabrics to shrink from 1.2% to 2.5%. Dry cleaning caused the fabrics to stretch .1% to 1%. Fabric number 3 was colorfast to light, laundry, dry cleaning, and perspiration (acid and alkaline).

CONCLUSION

Fabric number 3 was found to be more suitable for a dress, suit or play-clothes than fabrics 1 and 2.