

Weaving and Comparing
Cotton - Jute Furnishing Fabric
With Pure Cotton

By

R. Malathi

A THESIS SUBMITTED TO THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE
AND HIGHER EDUCATION FOR WOMEN (DEEMED UNIVERSITY) COIMBATORE-641 043,
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE
IN HOME SCIENCE TEXTILES AND CLOTHING

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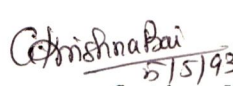
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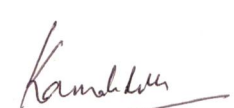
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Certificate as bonofide research work


Signature of the Head
of the Department


Signature of the
Dean of the Faculty


Signature of
the Guide

5.5.93

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Introduction

I INTRODUCTION

Textile products are an integral part of every persons daily life. They provide the basis for clothing, furnishings, domestic and industrial fabrics. Textile industry is the country's biggest organised enterprise. India's tradition in the manufacture of cotton fabrics is legendary.

Cotton is the most widely used of the textile fibres cotton has been of service to mankind for so long, that its versatility is almost unlimited and new uses are constantly being discovered, says Corbman (1987) cotton has a combination of properties like durability, comfort and versatility. Hence cotton clothes are desirable for summer wear, work clothes, towels and sheets.

This unique combination of properties has made cotton a standard for great masses of the world's people, who live in warm and subtropical climate. Eventhough manmade fibres have encroached

in the markets which was once dominated by 100 per cent cotton fabrics, the cotton is still able to maintain its position. No doubt cotton is the "king" of fibres.

Today, due to the increased population and deforestation, the cultivable lands of cotton has gone down while the demand has gone high. A time has come, when cotton has been replaced by synthetic materials which are the fruits of our scientific and technological advancement.

Synthetic materials have the advantage of easy care properties, wrinkle resistance, versatility and light weightness. They can be blended with any natural fibres to obtain variety and improved qualities. But at the same time synthetic fibres have certain demerits. Lack of absorbency makes it highly unsuitable for close fitting garments. They make the wearer feel warm by their heat retentivity. They produce static electricity and suffer due to pilling. Above all, the pollution caused by the synthetic fibre manufacturing industries forces people to think

whether they should encourage its production.

In fact, a day has come when people would like to revert back to the original cotton material to satisfy their clothing and furnishing requirement. Hence the thrust for consumption of cotton fibres is gaining momentum.

But it may not be possible to meet the entire clothing requirement of our growing population with cotton alone. Because urbanisation and deforestation have reduced the lands available for cotton cultivation. The only alternative is to use cotton in combination with jute, which is available in plenty in our country.

Right now pure jute is used mainly for making ropes and other packaging materials. It is hoped that the utility value of jute could be increased by mixing it with cotton. Hence in this study, an attempt has been made to weave a cotton-jute-union fabric, which could be used as furnishing material. With the intention of comparing

the same with pure cotton, a hundred per cent cotton furnishing material too was woven.

As washing is part of maintenance of any fabric, the investigator has also attempted to subject the two fabrics for washing after natural soiling. Dye absorption by the two fabrics was also compared.

The objective of the study is to weave and evaluate a cotton-jute union fabric in comparison with pure cotton to learn the extent to which a cotton-jute union fabric can replace cotton with regard to utility value and cost of production.

Review of Literature

II REVIEW OF LITERATURE

The literature pertaining to the study undertaken are reviewed under the following headings.

- A. Need for furnishing
- B. Materials suitable for furnishing
- C. Suitability of Jute for furnishing material
- D. Care of furnishing material and Maintenance
- E. Cotton-Jute Union fabric

A. NEED FOR FURNISHING:

Home furnishing, according to Ladbury (1985). Play an important role in satisfying personal and family living, and contribute to the pleasant environment for the development of the individual. Webster Universal dictionary (1970) refers furnishing as the act of equipping a house with furniture. Furnishing include furniture, carpeting and others for a room or a house. Furnishing refer to articles or accessories of dress with which anything is furnished says the Random house dictionary of the English language (1989).

Irene et al. (1980) remark that furnishing

includes the selection of furniture, floor coverings, window treatments and lighting. These features tastefully arranged can result in a home well suited to the activities and personality of the owner. Morton (1953) views that the fabrics for furnishing can be considered as the colthes of a room.

Buth (1967) stresses that furnishing helps to build the character and mode of each room. Hong (1965) says that the ultimate goal to be attained in a home is the successful integration of the three objectives beauty, expressiveness and functionalism. Beauty is that "Coimbination of qualities that is pleasing to the trained eye or ear". Expressiveness is the power to excite emotional response and avoid the suggestion of human attributes. Functionalism is based on function and they give the maximum of service, comfort and pleasure for the minimum of care.

Alexander (1977) says that many factors influence consumer choices in home furnishing. They are geographical location, climate, local customs, family size, age of children and life style.

Irene et al. (1980) views that windows are intended

to let in light and fresh air and to furnish with a view of the outside. Ball (1960) says that window curtains are used to modify the light and soften the window edges and provide privacy. Ruth (1972) remarks draperies as those which can add color and richness to the interior as well as help to reduce sun glare, provide privacy, provide insulation against heat loss and absorb sound. Hollen et al. (1979) suggests that carpets and rugs are also important items in home furnishings. According to encyclopedia of textiles both rugs and carpets are textile products of the loom. It also suggests that it is both functional article and the principal art form. It gives the room a sense of luxury, space and unity, say Irene et al. (1980).

B. MATERIALS SUITABLE FOR FURNISHING AND THEIR NATURE

According to Held (1978), all yarns are composed of fibres derived from living and growing things or the manufactured fibres. The suitability of a material for weaving is limited only by its appropriateness to the project for which it is intended. The materials suitable for furnishing are cotton, linen, silk, wool, man made or synthetics minor fibers like jute ramie and hemp.

Cotton

Alexander (1972) views cotton as the still widely used material despite the rapid rise in popularity of synthetics. Further he views that they serve for both the warp and weft, accepts dyes readily, are stable and durable. The range is almost infinite.

According to Shirley (1978) cotton yarns are more versatile of the natural fibres. It takes dyes which are fast to laundering and sunlight. It is economic, static free, can be made stain and water repellent, weather and wrinkle resistant, water proof laminated or bonded to other fabrics. Sherwood (1972) says that different kinds of fabrics light or heavy, delicate or strong can be made from cotton in a variety of style and qualities also can be blended with other fabrics. Irene et al. (1980) says that some of the cotton fabrics include cotton prints, chintz, cretonne, crash, home spun etc. Sherwood (1972) and Cook (1984) say that cotton is commonly used as an upholstery fabric for curtains, draperies, bed spreads blankets, towels and also for rugs and carpets.

Linen

Alexander (1977) says that linen is not commonly used as other fibres. It is appropriate for informal rooms. They are very durable, found in fabrics similar to cotton and homespun creotonne. According to Collen (1970), linen has most of cottons good qualities plus a few of its own. He says that it is absorbent, sound deading, moth proof and resistant to mildew, bacteria and dust. Shirley (1978) views linen as a high tensile strength variety and so a variety of weave is possible. Cook (1984) says that dimensional stability is not altered by direct or artificial light. It takes up all types of dyes. Linen can also be blended with cotton, rayon mohair and other fibres for reasons of economy or aesthetic effect. It is suitable for upholstery, slip covers, both heavy and sheer curtains as wells as wall coverings says Alexander (1977), Dantyagi (1974) states linen as smooth cool crisp to touch and have natural sheen, washes well.

Silk

According to Alexander (1972) Silk is called the queen of fibres. It is fine, lustrous and very long. The protein fibre is wrinkle and mildew resistant, moth proof

and takes dyes well Labarthe (1975) says that silk is damaged by sun. Drapes well, strong, luxurious in appearance and expensive. Hess (1978) views silk as the only natural fibre which can be woven or knitted directly into a fabric in its raw state, stronger than any other natural fibre absorbs moisture from atmosphere poor conductor of electricity possesses great elasticity and durability. Lee (1953) says that silk has the advantage of being the lightest in weight of all fibres. Held (1978) says that it can be used for curtains, upholstery and wall covering found in formal fabrics such as brocades, satin damask, brocatelle etc.

Wool

Held (1978) states that wool is a protein fibre which has low strength, high elasticity, gives excellent responsiveness to dyes and has medium flammability. Holland (1985) states that due to the crimp and scaly effect it retains heat and gives warmth. Wool is very resilient because of its natural crimp, knitting gives added elasticity. Irene et al. (1980) points out that wool is damaged by mildew, moth and other insects. It is high in static electricity. Wool is much more expensive

to produce than cotton and synthetics. Alexander (1972) opines that wool can be blended with cotton, rayon and nylon. It tends to soil readily but can be treated to increase soil resistance. Wool as a furnishing can be used for carpets, bed spreads and blankets. According to , Dantyagi (1983) important characteristics of wool are extensibility, elasticity, absorption, felting and chemical activity.

Man made fibres

a) Regenerated cellulose:

Cook (1984) says regenerated cellulosic fibres include Rayon and acetate. Dantyagi (1974) states that the main object in manufacturing rayon was to provide a cheap substitute for silk. Softness, coolness, lightness in weight and attractive appearance are responsible for the popularity of rayon. Viscose rayon is stronger than wool. It hangs well, absorbs dyes easily has high resistance to deterioration by sunlight fairly durable, washes well and economical says Alexander (1972) Cuprammonium rayon is suitable for curtains because it hangs well it takes dyes easily and prints well, can be made into sheer and heavier cloth moth resistant. Acetate is highly resistant to mildew. It is blended with other fibres to reduce its

cost, says Munro (1987). Both filament and staple rayon are used in upholstery and curtain fabric. They have good draping property, states Morton and Hearle (1975).

Thermoplastic or Synthetic fibres:

The advantage common to all man made fibres are their uniformity, freedom from waste and relative stability in supply and price says Vaidya (1988). In general, synthetic fibre are characterised by high strength, superior abrasion resistance and low density, very good crease recovery, excellent biological resistance, states Morton (1975). The durability of synthetic fibres is very high compared to viscose, cotton or wool, but there is a problem of pilling, the moisture regain is very low, views Cook (1984). It is not rapidly destroyed by acids, alkalies, bleaches, detergents. Maintains air space for warmth easy to washable and dries quickly. It has high resistance to moth, midew, insects and moulds.

Mineral fibres

The textile industry makes use of three minerals Asbestos which is natural and Glass and Metallic which are manmade. Glass and Asbestos are not attacked by chemicals.

Asbestos dyes easily but the colour is likely to be spotty and have poor colour fastness, states Labarthe (1975). Asbestos is used with glass fibre in making decorative fabrics for curtains and draperies for hospitals and libraries since they are flame proof. Fibre glass is stronger of all textile fibres and not affected by perspiration. It neither shrinks nor stretches. It is smooth and lustrous it is used where insulation is needed says Dantyagi (1974). They are suitable for draperies, ceiling, wall coverings denotes Moncrieff (1970). Metallie fibres can withstand bleaching, they are rot resistant and non-toxic. They are used in carpets, rugs, upholstery, drapery fabrics, slip covers and table cloths says Dantyagi (1974).

C. SUABILITY OF JUTE FOR FURNISHING MATERIAL

According to Cook (1984) jute has been used since prehistoric times. Jute grows to five meters with stalk diameter of 20 mm. Alexander (1972) says fabrics made from jute resemble linen but are much coarser and less resilient. Dantyagi (1974) opines that jute is the second most widely used vegetable fibre, exceeded only by cotton. The best quality jute fibre is a clear yellowish colour

with a fine silky lustre. It is soft and smooth to touch.

Cowan (1980) states that jute fibre is less strong than flax. It is highly hygroscopic, fairly absorbent, with irregularity in the thickness of cell walls. Lee (1953) states that jute has an elongation at break of about 1 - 7 per cent. Jute tends to be stiff. Jute is more resistant to rot than either gray cotton or flax. If kept dry, jute will last indefinitely. The American Home economics Association (1960) state that jute is the most easily spun and the cheapest of the important textile fibres, it can be processed with finishing agents to increase its durability and resistance to rot, microbial decomposition, water and fire. It can be treated with caustic soda to give it wool like characteristics. Venkataraman (1993) says that by giving chemical finishing treatment to 100 per cent jute or blended fibre, yarns or fabrics can be used as blankets, carpets furnishing and upholstery material and apparel fabrics. Cook (1984) says that various types of dyes can be applied in jute. It has great affinity to basic dyes but not fast to light and water, Direct, sulphur dyes are fast, vat and azoic are best.

D. CARE OF FURNISHING MATERIAL AND MAINTENANCE:

According to Wingate (1984) and Mohler (1984) Label information helps consumers a lot in the care of furnishing materials. They add that cotton and cotton blends can be washed in an automatic washer. No ironing is required only, starching is necessary for stiffness. Natural soap solution is used for washing linen draperies. Hall (1965) states that silk fabrics should be drycleaned. Man made fibres are machine washable and dryable. Glass fibred curtains are to be washed, by hand.

The most commonly used fabrics for covering upholstery are cotton, linen, silk, wool, polyester, rayon and nylon says Sheriwood (1972). Proper care includes frequent vacuum cleaning to prevent attacks by moth and to remove dirt. Stains should be removed immediately says Alexander (1977). Para dichloro benzene can be sprinkled to avoid infestation says Lyle and Brinkley (1983). Ladbury (1985) states that light coloured delicate fabrics require dry cleaning. Soapless cleaners must be used. Foam cleaner is preferable to liquid cleaner.

Rugs and carpets need regular vacuuming irrespective of the fibre out of which they are made says

Wingate (1964). Carpets should be rotated periodically to lengthen their life, views Alexander (1977) Rugs should be dusted with naphthalene powder or moth crystals while rolling and storing, states Funk and Waggmalls (1977). While storing furnishings moth repellents such as para dichloro benzene should be sprinkled in the folds, say Norma et al. (1979).

E. COTTON-JUTE UNION FABRIC

According to Ranjan (1973) jute is a comparatively cheap and a strong fibre and is freely available. It has many advantages for which it is most acceptable for packing, transport and storage of agricultural, mineral and industrial products and cloth for packing furniture upholstery, airport runways and road constructions, carpets backing, tarpaulin, linoleum and furnishings.

According to Pandey and Anantha Krishnan (1990) Jute is used in development of new cement bag, book binding cloth, wool, woolnised jute products, caplon blankets from jute-polypropylene blended yarn, different types of carpets from texturised jute. Jute-ramie blended yarn for development of upholstery, furnishing and industrial

fabric, jute-viscose for decorative fabric. Jute-polypropylene for upholstery and furnishing.

Cowman (1980) is of the opinion that jute is used for binding thread, in carpets rugs and linoleum. Burlap or hessian cloth is woven of jute used for inexpensive, decorative fabrics such as draperies, slip covers and garments. Using very fine refined jute a light weight fabric is made as a substrate in vinyl lamination. Sundra a new jute fabric is found which is color fast and shrinkage can be controlled.

According to Subramaniam (1983) jute has a bright future in the multi-fibre range, including a blend with cotton, wool and polyester, its diversified uses are listed below:-

1. Jute-viscose - decorative fabrics such as curtains, furnishing, wall coverings, tapestry etc.
2. 100 per cent jute - Book binding cloths and bags
3. Jute/wool - Blankets, wrappers, knitting Yarn

4. Jute-ramie - Upholstery, furnishing and industrial fabrics
5. Jute-acrylic - Blanket, carpet, knitted goods
6. Jute-polypropylene - Upholstery and furnishing
7. Jute agro-waste - Paper and fibre board.

Methodology

III EXPERIMENTAL PROCEDURE

The experimental procedure adopted for this study comprised the following steps.

- A. Selection of yarns
- B. Selection of weave
- C. Description of the loom
- D. Weaving
 - 1. Setting up of loom
 - 2. Preparation of yarn
 - 3. Steps in weaving
- E. Wear study
 - 1. Nomenclature of samples
 - 2. Method of soiling
 - 3. Method of washing
- F. Dyeing
 - 1. Preparation of fabric for dyeing
 - 2. Method of dyeing
 - 3. Evaluation
- G. Evaluation
 - 1. Visual inspection
 - 2. Laboratory tests
 - 3. Colour fastness tests
 - 4. Statistical analysis
 - 5. Cost comparism

A. SELECTION OF YARNS

The yarns selected for the study were cotton and jute both of them belong to the same category of cellulosic fibres. Hence they have similar properties like absorbency and strength. While cotton is popular in the apparel field. Jute occupies a prominent place in the list of packaging materials. As regards cost, jute is less costlier than cotton. In this modern era of deforestation cotton is becoming a rare commodity. To overcome this problem the investigator wanted to mix jute along with cotton and weave a fabric which could be used as a furnishing item.

Keeping the objective in mind cotton was chosen for the warp and jute for the weft. To facilitate comparison a hundred per cent cotton was also woven using cotton for both warp and weft.

The count of the available jute yarn was 3s. To suit the same, while weaving hundred per cent cotton material also cotton yarn of the count 3s was used for the weft direction. In both cotton-jute-union fabric and hundred per cent cotton material, cotton yarn of 10s count constituted the warp yarn, mainly based on the availability.

B. SELECTION OF WEAVE

According to Dantyagi (1983), furnishing materials are mostly plain woven. Because plain weave adds to the durability, drapability and easy launderability. It also gives very good results while printing. Hence plain weave was chosen for the study.

In addition, the study gave the investigator an opportunity to use a simple loom available in the Institution. Being a two harness loom, only plain weave was possible with the available loom.

C. DESCRIPTION OF THE LOOM

The loom (Plate-I) consisted of a wooden frame work. It had a warp beam to hold the warp yarns, while one end of the warp yarns was wound on the warp beam, the other end was connected to the cloth beam.

There were two sets of harness. Each harness was a frame carrying number of heddles. Each heddle contained an eye through which one warp yarn was passed. The harness controlled the up and down movement of the warp yarns.

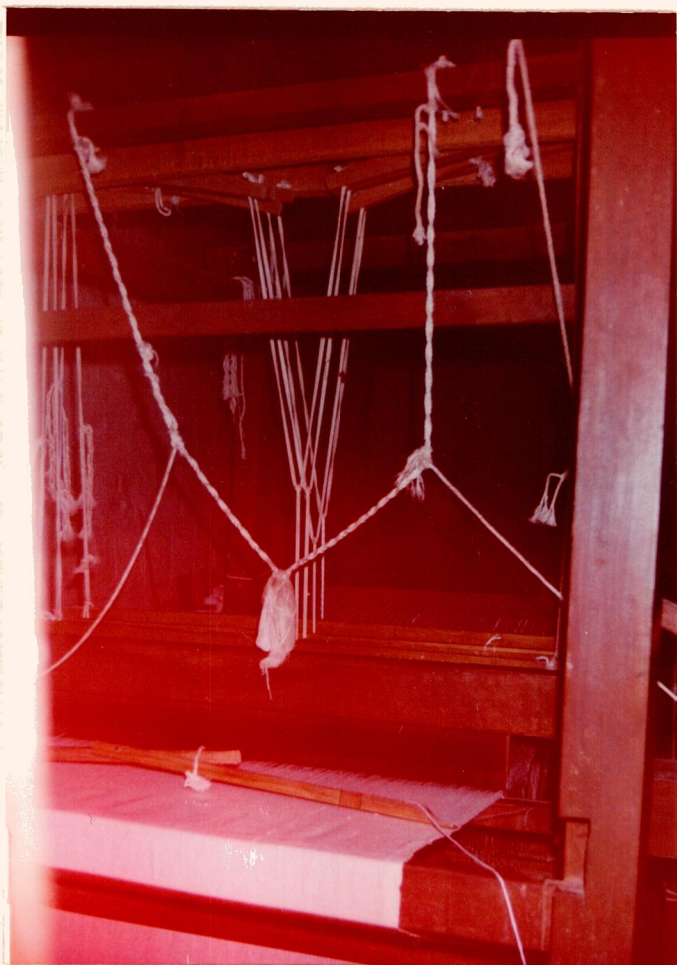


PLATE - I
LOOM

A boat shaped shuttle carried the filling or the weft yarn was passed forward and backward across the shed. Reed was a frame which was located directly in front of the harness. This frame was pushed forward each time, the shuttle passed in between the warp yarns and pressed back the filling thread in position. The woven fabric was rolled on a beam known as cloth beam which was in front of the loom.

D. WEAVING

1. Setting up of loom:

The warp yarns wound on the warp beam were sorted as odd and even numbered ones. All odd numbered yarns were passed through a set of harness while the even numbered ones were passed through the other set of harness. All yarns irrespective of their number, were passed through the reed and finally tied to the cloth beam.

The weft yarns were wound on spools using a Charka, Latter, the spool was placed inside a shuttle and one end of the thread was brought out through the small hole provided in the shuttle.

2. Preparation of yarn:

Weaving demands the preparation of warp and weft yarns separately. The weft yarns were spun to the desired size with a slight twist as they have to undergo less strain during the process of weaving.

The warp yarns underwent spooling, warping and slashing in order to withstand the strain of the weaving process. The yarns were wound on spools which were placed on a rack called a 'Creel'. From the creel, the yarns were wound on the warp beam. These yarns were again unwound and put into the sizing bath. The sizing used were starch based. This process was called slashing. Then the sized yarns were wound on the warp beam and arranged on the loom.

3. Steps in weaving:

The operations followed in the weaving, both for pure cotton and cotton-jute-union fabric were same as that of the one listed by Bernard (1985). It is summarised below:

1. Shedding - Raising specific warp yarns by means of the harness or heddle frame.

2. Picking - Inserting filling yarns through the shed.
3. Beating up - Pushing filling yarns firmly in place by means of the reed.
4. Taking up and letting off - Winding the finished fabric on the cloth beam and releasing more of the warp yarn from the warp beam.

About five meters of cloth was woven separately in pure cotton and cotton jute combination samples of the same are presented in Appendix (II).

E. WEAR STUDY

1. Nomenclature:

One meter of cloth was cut from each of the two varieties namely pure cotton and cotton-jute union fabric. They were named as A and B respectively and kept aside as original. The rest of the material was subjected to washing. The washed sample of pure cotton variety was named as A_1 and that of Cotton-Jute union fabric was named as B_1 .

2. Method of soiling:

The samples intended for washing namely A₁ and B₁ were used as a drapery fabric. To facilitate the drapery fabrics to soil naturally, samples A₁ and B₁ were draped separately, against a window for a period of twelve hours from morning six to evening six. At the end of the specified period, the draperies were subjected to washing.

3. Method of washing:

Surf is the most widely used detergent for washing both apparel and furnishing items says Thomas (1989). Hence the same was chosen for washing the samples. After each days exposure, the samples were washed with one per cent detergent solution adopting kneading and squeezing method. According to Dantyagi (1983) kneading and squeezing is the ideal method for washing clothes as it does not damage the fibres. After thorough washing, each of the samples were rinsed in three changes of soft water and dried. Thus each of the samples underwent twenty five washes, after which they were subjected to evaluation.

F. DYEING

With the intention of comparing the dye absorption by pure cotton and cotton jute material, quarter meter material from each of the original was cut and subjected to dyeing.

1. Preparation of fabric for dyeing:

Since the starch present in the woven material might hinder the absorption of dye, it is essential that the gray cloth is subjected to scouring and mercerisation as prior treatments says Sadev et al. (1978).

Both pure cotton and cotton jute material were scoured and mercerised. The following chemicals as suggested by Taltersal (1975) were used for boiling the sample at a liquor ratio of 1:20

Sodium hydroxide	-	2.5%
Soda ash	-	2.5%
Liccapul.D		
P.V. Liquid	-	0.5%

The material was boiled for 30 minutes in the above solution, rinsed thoroughly in soft water and dried.

2. Method of Dyeing:

Joseph (1972) opines that naphthol dyeing involves the following steps.

1. Impregnation of the material with Naphthol solution.

2. Developing the impregnated material with diazotised fast base.

3. Soaping of the material so dyed.

The naphthol dye powder was made into a smooth past using monopol soap. To this boiling water was added. The solution was stirred well and sodiumhydroxide was added. After thorough stirring, the solution was kept aside.

The base was made into a smooth paste with enough cold water. To this, hydrochloric acid was added. The remaining water was added and the solution was stirred well. Diazotisation was brought about by the addition of sodium nitrite. The addition of sodium acetate and aluminium sulphate brought the base solution to completion.

Care was taken to prepare the Naphthol and Base solution separately using two different beakers and stirrers. The samples were first dipped in the naphthol

solution after thorough wetting. It remained in the solution for about ten minutes, with constant stirring. Then the sample was taken out, squeezed well, opened out and dipped in the base solution for the same duration of time as that of Napthol. The dyed samples were after treated by rinsing in cold water and then given soap boiling. The dyed samples are presented in Appendix (III).

3. Evaluation:

The dyed samples were evaluated visually for evenness of dyeing and also for colour fastness properties.

G. EVALUATION

1. Visual inspection:

The samples both in their original gray form, as well as after washing, were evaluated visually using a proforma given in the Appendix (I). A panel of 25 postgraduate students, specialising in the field of textiles and clothing were selected as judges for evaluating the samples. General appearance, texture and lustre were the main aspects taken into consideration for visual inspection.

2. Laboratory tests:

The following laboratory tests were conducted

- a. Fabric weight
- b. Fabric thickness
- c. Bursting strength
- d. Drapability
- e. Abrasion resistance
- f. Stiffness

a. Fabric weight:

Weight is an important fabric property when comparing similar fabric construction says Lyle (1977). According to Grover and Hamby (1960) and Skinkle (1972), fabric weight is expressed as mass per unit area and weight per unit length. The simplest unit is ounces per square yard. Eureka Brand cloth Quadrant Balance was used to find out the weight of the sample (Plate II). It had a copper quadrant scale graduated in ounces per square yard. The samples were cut from different places of the sample using a template each of the sample was suspended on the hook of the balance and the reading was noted. Ten readings were taken and the mean weight was calculated. This was expressed as ounces per square yard.

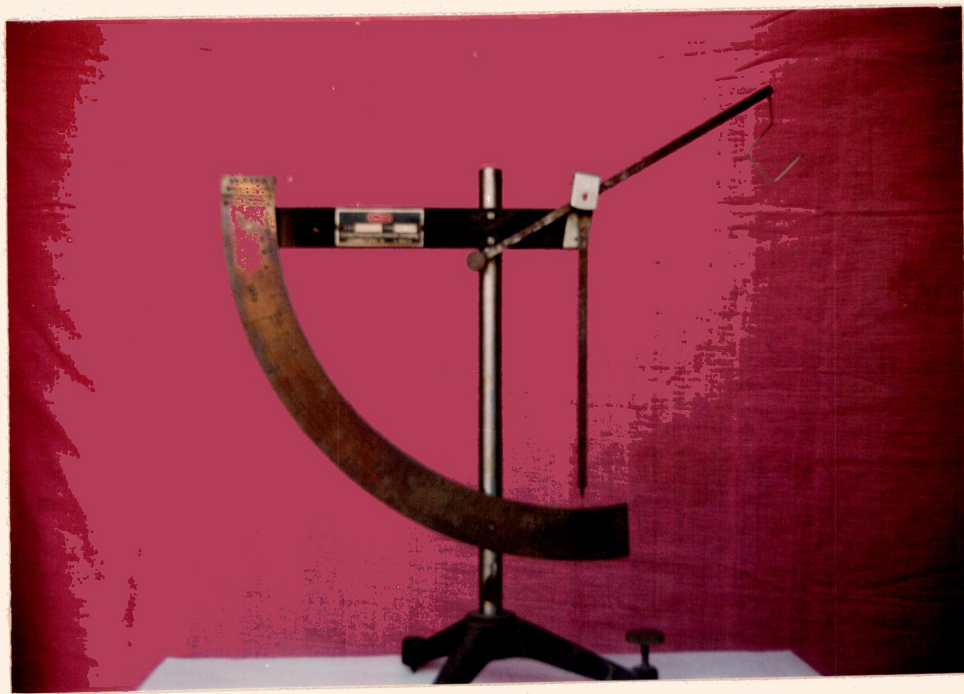


PLATE - II
CLOTH QUADRANT BALANCE

b. Fabric thickness:

Fabric thickness is the measurement of the distance between two plane parallel plates when they are separated by the cloth, while the pressure applied is maintained, says Booth (1968).

The Hungarian Thickness Tester was used (Plate III). It had two parts, the anvil and the pressure foot, which worked under a lever spring action. On the top a dial indicated the thickness of the sample in thousands of an inch. Each division on the dial read 0.01 mm. The sample was placed on the anvil plate and the lever of the pressure foot was released very slowly and the pressure foot pressed the sample. The dial indicated the thickness of the sample. Ten readings were taken from different places of the sample and the mean was calculated.

c. Bursting strength

Grover and Hamby (1969) say that the bursting test measures a composite strength of both warp and filling yarns simultaneously and indicate the extent to which a fabric can withstand a bursting type of force with the

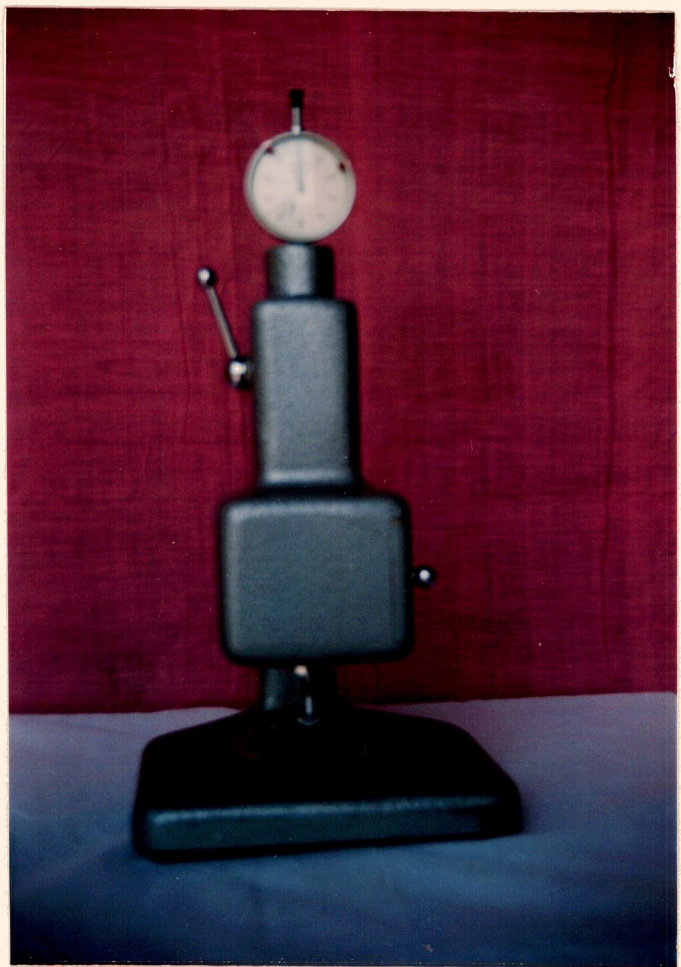


PLATE - III
FABRIC THICKNESS TESTER

pressure being applied perpendicular to the surface of the fabric. Eureka Brand Bursting strength tester was used (Plate IV). The bursting tester had a rubber diaphragm and a ring clamp mechanism for holding the sample. A rotating handle enables to increase the pressure and burst the sample. There were two dials in which the readings were callibrated in pounds per inch and kgs. per cm sq.

The sample was sequirely clamped using the clamping device the load or pressure was increased by rotating the handle in clock-wise direction to burst the material. Care was taken to stop the mechanism after the sample ruptured. Samples were taken in different places and ten readings were taken and the mean was calculated.

d. Drapability

ISI (1982) refers Drape as one of the subjective performance characteristics of fabrics that contribute to aesthetic appeal. It is a complete property involving bending and shearing deformations. Draping quality is expressed as drape coefficient which theortically varies between 0 and 100. The Eureka Drape Tester was used (Plate V). There was a round horizontal platform. When the light was on the image was formed on the top of the glass cover.



PLATE - IV
BURSTING STRENGTH TESTER



PLATE - V
DRAPE - TESTER

The sample was cut using a round template which was 24 cms in diameter. Using this three brown papers were also cut. The material was draped on the platform and the image was drawn on the brown papers. The weight of the brown paper initially and finally after cutting to the image were recorded. The coefficient percentage was found out using

$$\text{the formula} = \frac{M_2}{M_1} \times 100$$

M_1 - Initial weight of the paper

M_2 - Weight of the paper after cutting.

e. Abrasion test

Skinkle (1972) is of the opinion that abrasion is the important factor and it is the friction between the cloth and some other material. Eureka Brand Abrasion Tester was used (Plate VI). The samples were abraded on a abradent material for a particular number of revolutions. Ten samples were cut using the metal template of 1 1/4 inch diameter at various places and the weight of each one was noted. The abradent used was universal carborundum 400 super fine Emery paper. The samples were mounted on the holder with 400 gms. weight and thirty revolutions were given to pure cotton and ten revolution were given to



PLATE VI

ABRASION RESISTANCE TESTER

cotton-jute-union fabric. The final weight was taken after a hole has been formed on the sample and the mean of five readings was found.

f. Stiffness:

Shirleys stiffness Tester (Plate VII) was used to determine the stiffness in bending length, using a scale of six inches length and one inch width which formed the template, ten samples were cut both in the warp and weft directions. Each sample along with the scale were mounted on the platform which was horizontal and the template was moved along with the fabric slowly until the fabric fell to the edge of the platform and the tip of the fabric coincided with the index line which was viewed in the mirror. The bending length was read from the scale mark opposite to the 0 line on the side of the platform. Ten readings were taken and the mean was calculated.

3. Colour fastness:

The outstandingly property of the dyed material is the fastness of its shade, declares Trotman (1984). When a dye is present on a fabric it is expected to have certain fastness properties adds Shenai (1983).



PLATE - VII
STIFFNESS TESTER

The following colourfastness tests were conducted to determine the colourfastness of the dyed samples.

- a) Colourfastness to sunlight
- b) Colourfastness to washing
- c) Colourfastness to dry and wet crocking
- d) Colourfastness to dry and wet pressing

a) Colourfastness to sunlight:

Lyle (1976) points out that colourfastness to light is expected from all fabrics but is most important in home decorator fabrics. The majority of colours become lighter in hue when exposed to light. Some become darker in hue.

A sample piece of 8 x 1" was cut from the dyed material. The eight inch portion was divided exactly into eight divisions of one inch width. The strip was covered with black chart paper. On the first day, 1st division was cut and exposed, consequently, 2nd division was cut on the 2nd day and so on. Finally, the first division after exposing it for seven days, was compared with the original which was in the 8th division. Each divisions of the sample was checked for colour change on exposure to sunlight. Change in colour was determined using a

grayscale.

b) Colourfastness to washing:

Textile Handbook (1966) states that all fabrics must withstand cleansing, colourfastness to washing and dry cleaning. The test samples of 3 x 3" size were cut from the dyed materials. Each sample was sandwiched between the undyed cloth which has been desized well.

Soap solution of about 5gms/litre was prepared. Each of the test samples was soaked in the soap solution separately for about half an hour. After that the test samples were removed, rinsed in cold water, thoroughly squeezed well and dried.

The colour change and staining of the sample was assessed in comparison with the Gray scale (Appendix V).

c) Colourfastness to dry and wet crocking:

Lyle (1976) stresses that fastness to crocking by rubbing is important in both apparel fabrics and those used for upholstery.

A standard device known as the corckmeter is intended for this test state, Linton and Pizzuto (1951).

Each of the dyed samples was cut to a size of 10 x 8" and mounted on a flat base. A white material was mounted on to the rubbing finger with a ring. Each sample was given 10 rubs, after the number of rubs to be given was standardized. The colour transfer from the dyed sample to the white material was assessed using Gray Scale.

A damp white material was used, for wet crocking. But the procedure adopted was same as that of dry crocking.

d) Colourfastness to Dry and wet pressing:

As suggested by Wingate (1964) a dyed sample of 2 x 4" size was sandwiched with a white material for both dry and wet pressing. Then, the dyed samples were pressed with a hot iron for 15 seconds. The samples under dry and wet conditions were assessed for colour change and staining using a Gray Scale.

4) Statistical analysis:

The results of the laboratory tests were analysed statistically, selecting appropriate tests.

The difference between pure cotton and cotton-jute union fabric both before and after washing was analysed statistically using students 't' test, to learn whether the difference was significant or not.

According to Gupta (1988) the 't' distribution is commonly called students distribution. The 't' distribution is used when sample size is 30 or less and the population standard deviation is unknown. A model of the 't' test is presented in Appendix IV.

5) Cost comparision:

The expenditure incurred on the production of cotton-jute-union fabric and 100 per cent cotton was compared.

Results and Discussion

IV RESULTS AND DISCUSSIONS

The results obtained in the study are discussed under the following heads.

- A) Visual Inspection
- B) Laboratory Tests
 - 1) Fabric weight
 - 2) Fabric thickness
 - 3) Bursting strength
 - 4) Drapability
 - 5) Abrasion resistance
 - 6) Stiffness
- C) Colour Fastness Tests
- D) Cost comparison

A) Visual Inspection

The results obtained in the visual inspection are presented in table I.

TABLE - I

VISUAL INSPECTION

S. No.	Percentage of judges stating	Samples			
		A	A ₁	B	B ₁
1	General Appearance				
	Good	75	80	-	78
	Fair	25	20	75	22
	Poor	-	-	25	-
2	Texture				
	Soft	-	75	-	72
	Medium	80	25	67	28
	Coarse	20	-	33	-
3.	Lustre				
	High	-	65	-	-
	Medium	68	35	23	68
	Low	22	-	77	32

From the above table it is obvious that the pure cotton original sample 'A' was rated as good in general appearance by 75 per cent of the judges, while the rest of the judges considered the same as fair. In contrast, the cotton-Jute original material 'B' was considered to be fair in general appearance by 75 per cent of the judges while

the rest of the judges considered the same as poor.

On washing, the pure cotton sample 'A₁' and the cotton-Jute sample 'B₁' were rated to be good in appearance by 80 and 78 per cent of the judges respectively.

As regards texture the pure cotton original sample 'A' and cotton-Jute original sample 'B' were considered to be medium by 80 and 67 per cent of judges respectively.

On washing, the pure cotton sample 'A₁' and cotton-Jute union fabric 'B₁' were rated to be soft in texture by more than 70 per cent of the judges.

With reference to lusture, it is obvious that in the original form the pure cotton sample 'A' was rated to be medium by 68 per cent of the judges, while the cotton-Jute original sample 'B' was considered to be low by 77 per cent of the judges.

After washing the pure cotton sample 'A₁' was rated to be high in lustre by 65 per cent of the judges while the cotton-Jute union fabric 'B₁' was rated to be only medium in lustre by 68 per cent of the judges.

Hence it may be concluded that washing has definitely improved the general appearance, texture and lustre of cotton-Jute union fabric more than pure cotton.

B) Laboratory Tests

1) Fabric Weight

The fabric weight of the samples are presented in Table-II and Figure-I.

TABLE - II
FABRIC WEIGHT

S. No.	Samples	Mean Weight per square yard in ounces	Loss or gain over original	Percent age loss or gain	't' test	
					Samples compared	Value
1.	Original 100% cotton-A	8.5			AA ₁	2.443
2.	Washed 100% cotton-A ₁	9.2	0.7	8.2	BB ₁	9.0782*
3.	Original cotton Jute union Fabric-B	8.6			AB	0.6393
4.	Washed cotton Jute union Fabric-B ₁	9.9	1.3	15.1	A ₁ B ₁	2.505

* Significant

SCALE

ON X AXIS 1 cm = 1 cm

ON Y AXIS 2 cm = .5 cm

X AXIS - SAMPLES

Y AXIS - FABRIC WEIGHT IN
OUNCES / SQUARE YARD

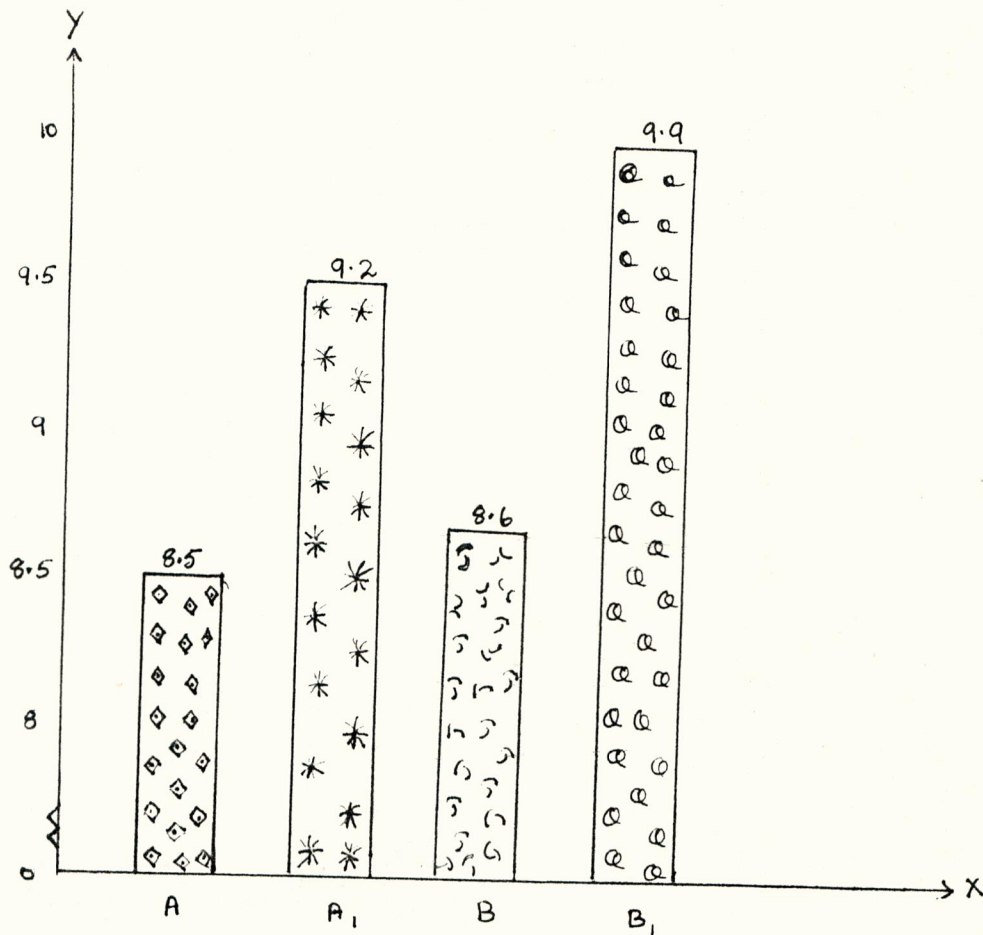


FIGURE - I

FABRIC WEIGHT

From table II it is evident that washing has increased the fabric weight of the samples, no matter whether it is pure cotton or cotton-jute union fabric. The difference in the fabric weight of the original pure cotton (A) and cotton-jute union fabric (B) seems to be a meagre one while the former is 8.5 the latter is 8.6 ounce/square yard. The gain in weight due to washing was 15.1 per cent in sample B_1 while the same was 8.2 per cent in the case of sample A_1 .

When the above results were analysed statistically it was found that the difference between samples BB_1 alone was significant at 1 per cent level. While the others namely difference between AA_1 , AB and AB_1 were insignificant.

Hence it can be inferred that washing has a significant impact on the fabric weight of cotton-jute union fabric rather than on pure cotton.

2) Fabric thickness

The fabric thickness of the samples are shown in table III and Figure II.

TABLE - III
FABRIC THICKNESS

S. No.	Samples	Mean thickness in mm	Loss or gain over original	Percent -age loss or gain	't' Test	
					Samples compared	Value
1.	Original 100% cotton-A	.70			AA ₁	.8849
2.	Washed 100% cotton-A ₁	.71	.01	1.8	BB ₁	2.654*
3.	Original cotton jute union fabric-B	.75			AB	4.424*
4.	Washed cotton jute union fabric-B ₁	.78	.03	4	A ₁ B ₁	12.5*

* Significant

From the above table it is evident that the cotton-jute union fabric (B) is thicker than pure cotton (A) by 7 per cent, even in the gray stage. On washing, both samples A₁ and B₁ showed an increase, which was found to be 1.8 and 4 per cent respectively.

A statistical analysis of the above results reveal that there is significant difference between samples BB₁, AB and A₁B₁. The difference between sample A and A₁ alone

SCALE

ON X AXIS 1 CM = 1 CM

ON Y AXIS 1 CM = 0.1 MM

X AXIS - SAMPLES

Y AXIS - FABRIC THICKNESS
IN MM

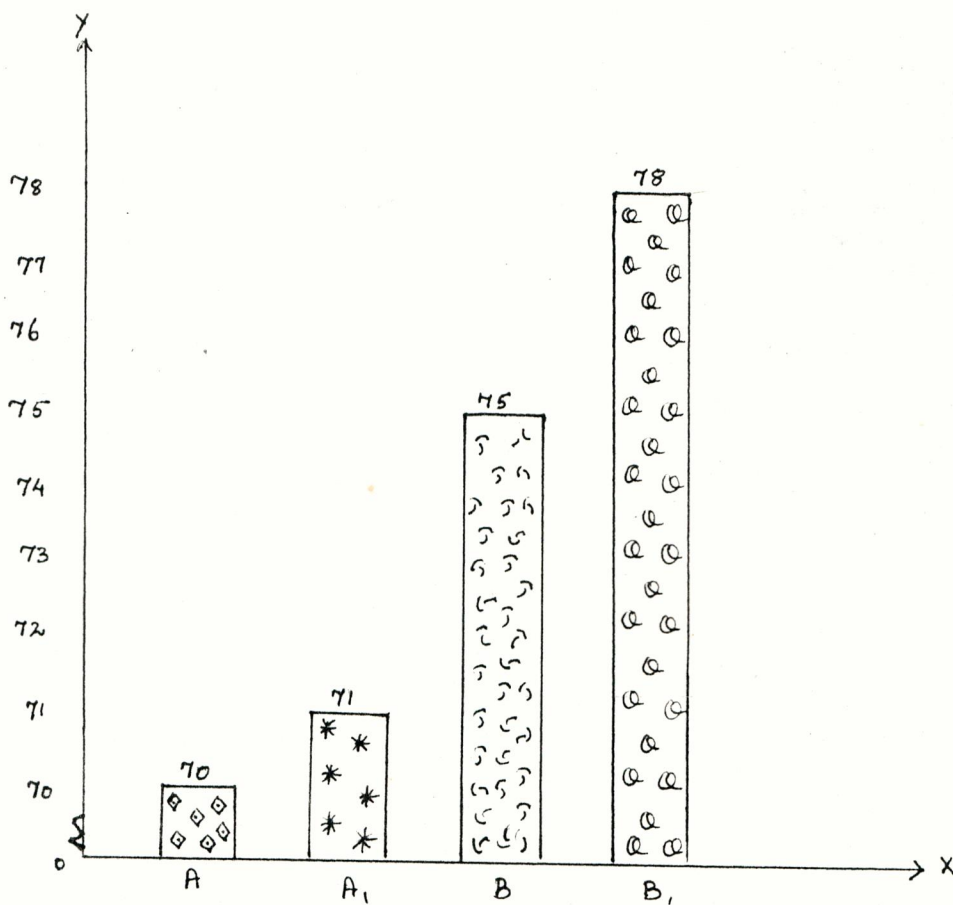


FIGURE II
FABRIC THICKNESS

was found to be insignificant.

From the above, it may be concluded that the fabric thickness of cotton-jute union fabric is influenced significantly by washing when compared to pure cotton.

3) Bursting Strength

Table IV and Figure III deals with the bursting strength of the samples.

TABLE - IV
BURSTING STRENGTH

S. No.	Samples	Mean strength in kgs.	Loss or gain over original	Percent -age loss or gain	't' Test	
					Samples compared	Value
1.	Original 100% cotton-A	9.875			AA ₁	31378
2.	Washed 100% cotton-A ₁	11.475	1.6	16.20	BB ₁	4.6273*
3.	Original cotton jute union fabric-B	12.625			AB	6.2894*
4.	Washed cotton jute union fabric-B ₁	9.875	-2.75	-21.78	A ₁ B ₁	2.4453

* Significant

SCALE

ALONG X AXIS 1 cm IS 1 cm

ALONG Y AXIS 2 cm IS 1 cm

X AXIS - SAMPLES

Y AXIS - BURSTING STRENGTH
IN KGS

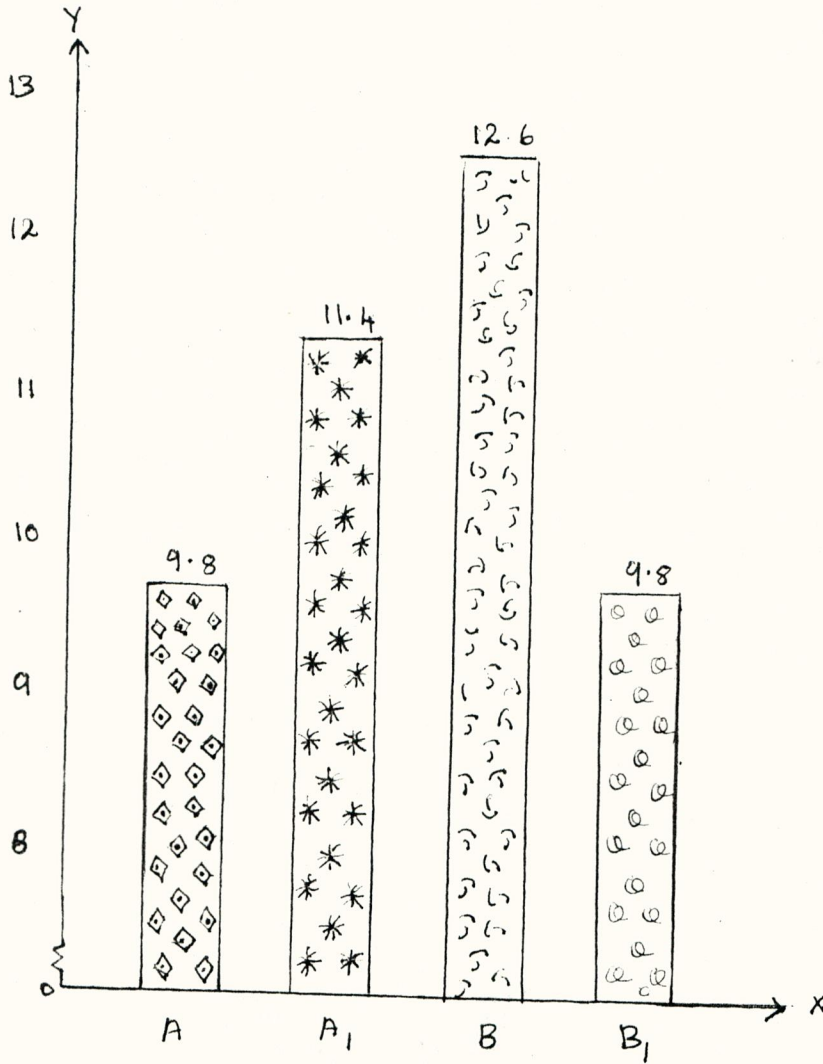


FIGURE - III

BURSTING STRENGTH

From table IV, it is clear that in the gray stage, cotton-jute union fabric (B) excels pure cotton (A) in bursting strength. While the former has 12.6 kgs. as mean bursting strength, the latter has only 9.87 kgs. On washing, sample A_1 gained strength by 16.2 per cent but sample B_1 lost strength by 21.78 per cent.

The statistical analysis reveals the presence of a significant difference between sample A and B and also between samples B and B_1 . The difference between AA_1 and A_1B_1 was found to be insignificant. Hence it is obvious that washing reduces the bursting strength of cotton-jute union fabric significantly.

Considering Bursting strength, it may be concluded that cotton-jute union fabric is suitable for items like furnishing which are not washed daily.

4) Drapability

Table V and Figure IV depict the drape coefficient of the samples.

TABLE - V
DRAPABILITY

S. No.	Samples	Mean coeff- -icient %	Loss or gain over original	Percent -age loss or gain	't' Test	
					Samples compared	Value
1.	Original 100% cotton-A	7.463			AA ₁	5.333*
2.	Washed 100% cotton-A ₁	12.696	5.233	70.11		
3.	Original cotton jute union fabric-B	9.613			BB ₁	3.806
4.	Washed cotton jute union fabric-B ₁	18.833	9.22	95.9		

* Significant

From table V it is understood that the drape coefficient of cotton-jute union fabric namely sample B is higher than that of pure cotton namely sample A. The drape coefficient was found to be 9.6 and 7.46 respectively. Washing has increased the drape coefficient of samples A₁ and B₁ by 70.1 and 95.9 per cent respectively.

The statistical analysis reveals that there is significant difference between samples A and A₁.

SCALE
 ALONG X AXIS 1CM IS 1CM
 ALONG Y AXIS 1CM IS 1CM
 X AXIS - SAMPLES
 Y AXIS - DRAPR CO-EFFICIENT
 IN PERCENTAGE

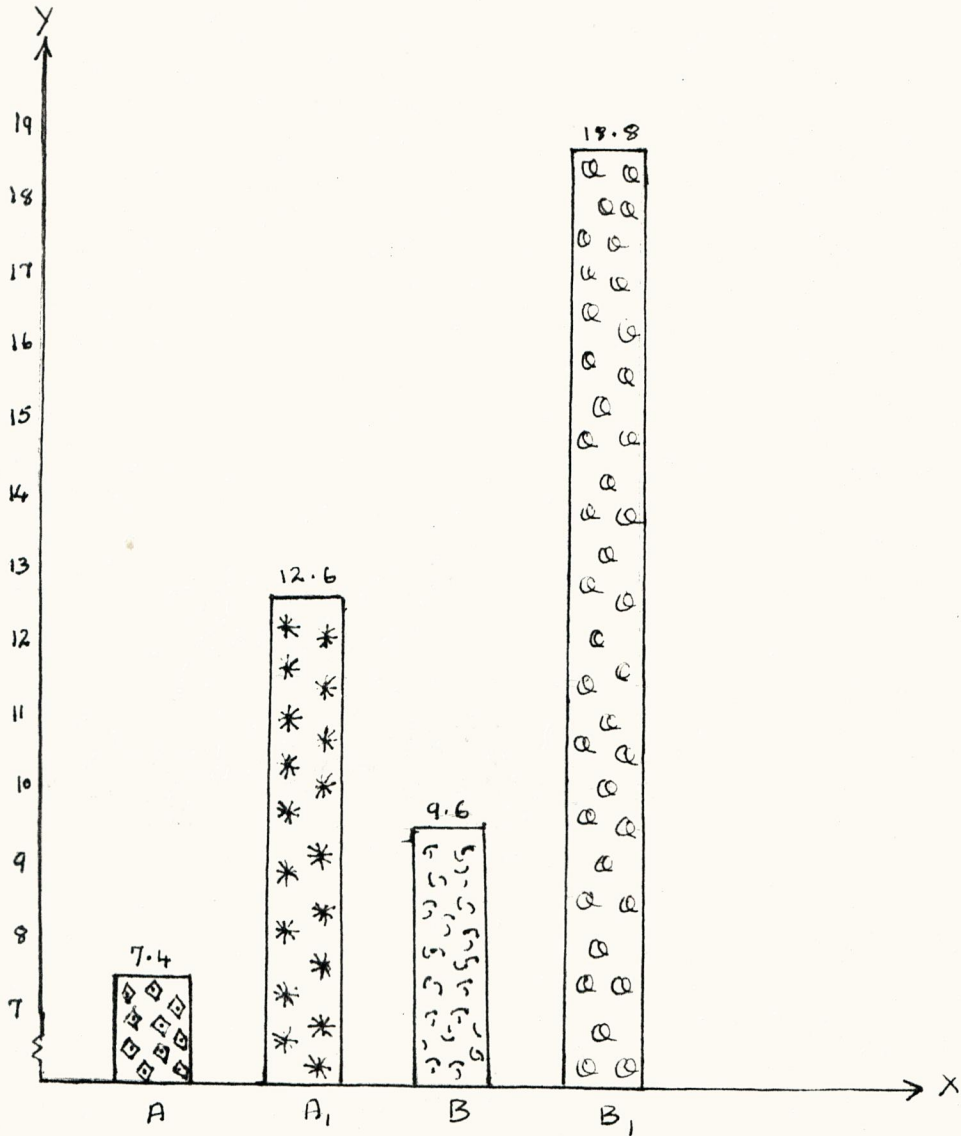


FIGURE - IV
 DRAPABILITY

5) Abrasion Resistance

The following table and Figure V deals with the Abrasion resistance of samples.

TABLE VI

ABRASION RESISTANCE

S. No.	Samples	Mean in MGS	Loss or Gain over original	Percentage loss or gain	't' Test Samples compared	Test Values
1.	Original 100% cotton - A	25.5			AA ₁	1.0602
2.	Washed 100% cotton - A ₁	22.2	-3.3	-12.94	BB ₁	1.7063
3.	Original cotton-jute-union fabric - B	12.1			AB	3.6368*
4.	Washed cotton-jute--union fabric - B ₁	7.2	-4.9	-40.49	A ₁ B ₁	6.7455*

* Significant

From the above table it is obvious that the loss due to abrasion is more in pure cotton (A) than in cotton-jute union fabric (B) even at the gray stage. The former was 25.5 mgs while the later was only 12.1 mg. On washing, sample A₁ had a loss of 12.94 per cent while B₁ had a loss of 40.49 per cent.

SCALE

ALONG X AXIS 1CM IS 1CM

ALONG Y AXIS 1CM IS 2CM

X AXIS - SAMPLES

Y AXIS - ABRASION
RESISTANCE
IN MG

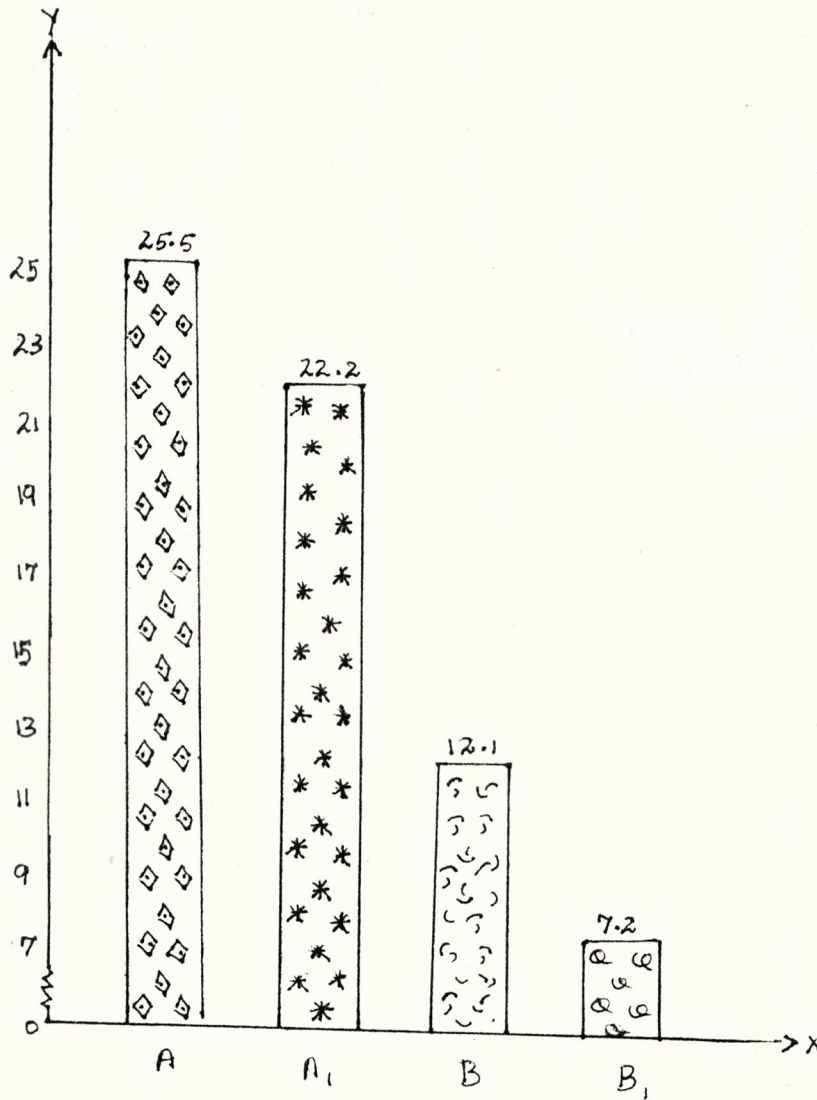


FIGURE - V

ABRASION RESISTANCE

On analysing the result statistically, it was found that the difference between sample A and B, A_1 and B_1 were significant at one per cent level. The difference between sample AA_1 and BB_1 where insignificant.

Hence it is clear taht cotton-jute union fabric lacks abrasion resistance when compared to pure cotton.

6) Stiffness

The stiffness of samples are presented in Table VII and figure VI.

TABLE VII
STIFFNESS

S. No.	Samples	Mean Stiffness in CMS	Loss or Gain over original	Percentage loss or gain	't' Test Samples compared	Test Values
1.	Original 100% cotton - A	2.9			AA_1	3.476*
2.	Washed 100% cotton - A_1	2.3	-0.6	20.68	BB_1	0.90171
3.	Original cotton-jute-union fabric - B	1.3			AB	11.7061*
4.	Washed cotton-jute--union fabric - B_1	1.4	0.1	7.69	A_1B_1	5.8785*

* Significant

SCALE
 ALONG X AXIS 1cm IS 1cm
 ALONG Y AXIS 1cm IS .5cm
 X AXIS - SAMPLES
 Y AXIS - STIFFNESS IN CM

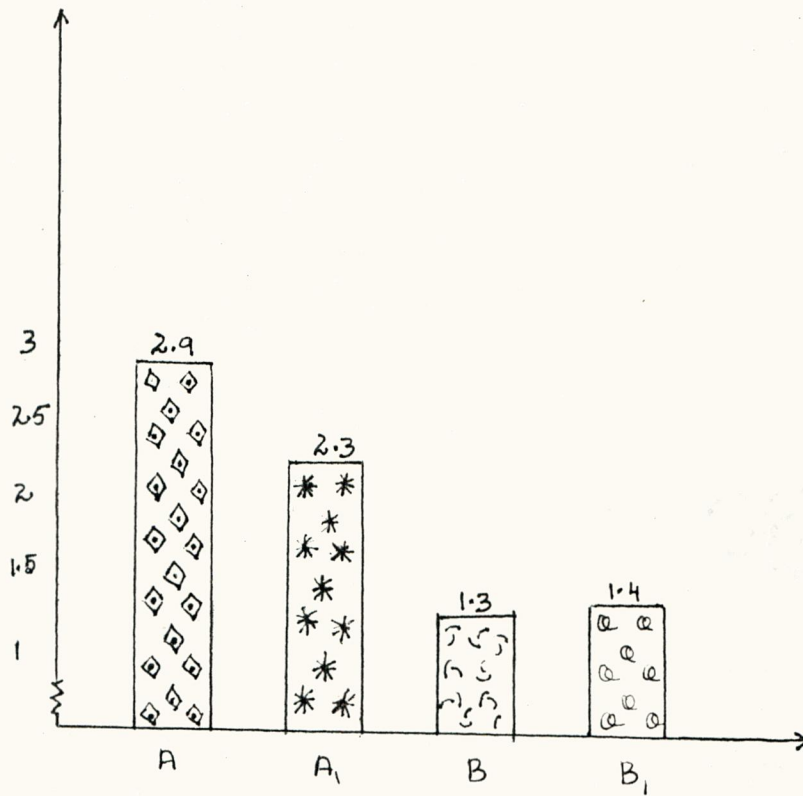


FIGURE - VI
 STIFFNESS

From the above table, it is clear that the stiffness of pure cotton (A) is better than that of cotton-jute union fabric (B) even in the gray stage. The stiffness in the former was 2.9 cms while that of latter was 1.3 cm. On washing, pure cotton (A) lost stiffness by 20.6 per cent whereas cotton jute union fabric (B_1) gained stiffness by 7.69 per cent.

Statistical analysis reveals that there is significant difference between A and B, A and A_1 , and A_1 and B_1 . But the difference between BB_1 was insignificant.

Hence, it is evident that washing improves the stiffness of cotton jute union fabric.

C Colour Fastness Tests

The details of the colour fastness tests of the dyed samples are given in Table VIII.

TABLE VIII
COLOUR FASTNESS OF DYED SAMPLES

Samples	Colour fastness						
	To Sunlight	To washing		To crocking		To Pressing	
	Colour change	Colour change	Stain-ing	Dry stain-ing	Wet stain-ing	Dry stain-ing	Wet stain-ing
Pure Cotton	4/5	4/5	5	4/5	3/4	5	4/5
Cotton Jute Union fabric	4/5	4/5	5	4/5	3/4	5	4/5

From the above table it is evident that the response of dyed pure cotton and cotton jute union fabric to colour fastness tests are more or less the same.

From the colourfastness test to sunlight it is evident that both pure cotton and cotton jute union fabric are highly colourfast to sunlight, as the colour remained the same as that of the original even after a week exposure.

As regards colourfastness to washing both the samples proved themselves to be colour fast as they have

not even stained the white material that was attached to the sample.

In dry crocking test, the two samples namely pure cotton and cotton-jute union fabric, displayed high colour fastness causing no stain on the white fabric. In wet corcking, the cotton-jute union fabric caused light staining on the white material, whereas pure cotton was found to be highly colour fast.

In both dry and wet pressing the pure cotton and cotton-jute-union fabric revealed high colour fastness causing no stain on the white material.

Hence it may be concluded that the colour fastness property of cotton-jute union fabric is more or less the same as that of pure cotton.

D) Cost Comparison

The total cost incurred in weaving cotton-jute material was Rs. 11.80/meter. But the same wa found to be Rs. 16.80/meter in the case of pure cotton.

Hence it can be concluded that weaving cotton-jute union fabric is more economical when compared to the weaving of pure cotton.

Summary and Conclusion

V SUMMARY AND CONCLUSION

Textile products are the integral part of everyone's daily life. They provide the basis for clothing, domestic and industrial fabrics. Among various fibres cotton is the most widely used textile fibre owing to its versatility and comfortability.

The only drawback of cotton is that it requires frequent starching and ironing to overcome this problem, people would like to use synthetics, both for apparel and furnishing purposes. But synthetic fibres possess problem in disposal beside causing health hazards. The pollution caused by the synthetic fibre manufacturing firms are threatening the entire world. Hence, people would like to revert back to cotton which is a pollution free fibre.

The growing population, deforestation and urbanisation have resulted in the demand for cultivable lands of cotton, which has made cotton fabrics costly and scarce. A time has come to blend cotton with other natural fibres like jute which is available in abundance. An attempt has been made in this study to compare a Cotton-Jute union fabric with pure cotton.

The procedure adopted for this study includes weaving of Cotton-Jute union fabric and also a pure cotton fabric for comparison. Cotton of 10s count was used as warp in both the fabrics. Jute of 3s count used as weft in the union fabric. While cotton of 3s count was used as weft in pure cotton. Both the fabrics were used as curtain material and draped against a window for a period of 12 hours a day. After everyday's use the samples were washed in soft water using 5 per cent detergent solution. The method adopted for washing was kneading and squeeing. Each of the sample underwent a total of 25 washes after which they were evaluated both visually and by laboratory tests. The tests included fabric weight, thickness, bursting strength, abrasion resistance, drapability and stiffness. A portion of the samples were dyed with naphthol dye and tested for colour fastness to sun-light, washing, crocking and pressing.

Following are the findings of the study

1) Washing has definitely improved the general appearance, texture and lustre of Cotton-Jute union fabric when compared to pure cotton.

2) Washing has a significant impact on the fabric

weight and thickness of union fabric rather than pure cotton.

3) Bursting strength of the union fabric reduced significantly compared to pure cotton.

4) Both the fabrics showed an increase in drape coefficient.

5) Cotton-Jute union fabric proved itself more resistant to abrasion than pure cotton.

6) Stiffness of Cotton-Jute union fabric was more than pure cotton.

7) Both the fabrics were found to be highly colourfast.

8) Production of Cotton-Jute union fabric was more economical than pure cotton.

Hence, it may be concluded that for furnishing purpose Cotton-Jute-Union fabric is preferable to pure cotton.

Recommendations

Based on the results obtained in this study the following recommendations are made.

1) Comparison of Cotton-Jute-Union fabric with 100 per cent Jute.

2) Effect of water (hard and soft) on the performance of Cotton-Jute union material.

3) Application of special finishes on Cotton-Jute union fabric.

4) Blending of Cotton-Jute union fabric for apparel.

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Appendices

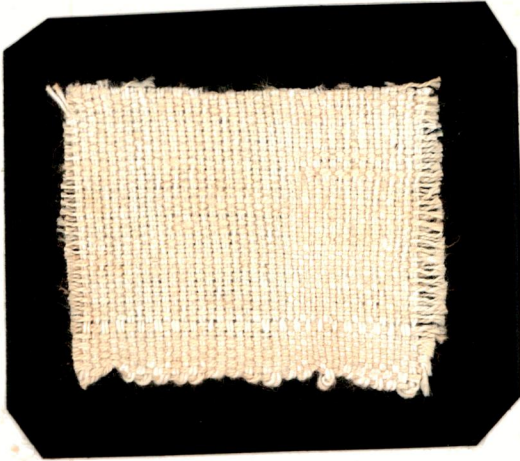
APPENDIX - I

PROFORMA FOR VISUAL INSPECTION

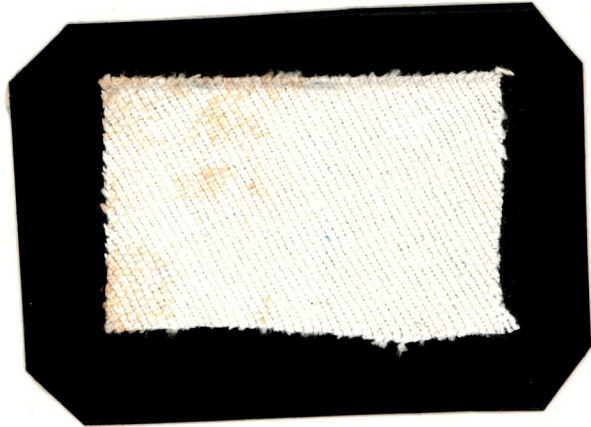
S. No.	Percentage of judges stating	Samples			
		A	A ₁	B	B ₁
1	General Appearance				
	Good				
	Fair				
	Poor				
2	Texture				
	Soft				
	Medium				
	Coarse				
3.	Lustre				
	High				
	Medium				
	Low				

APPENDIX - II

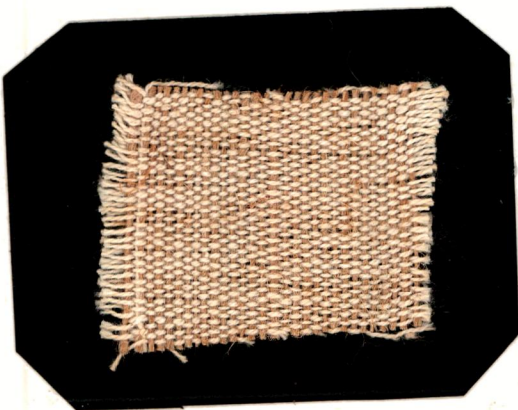
WOVEN SAMPLES



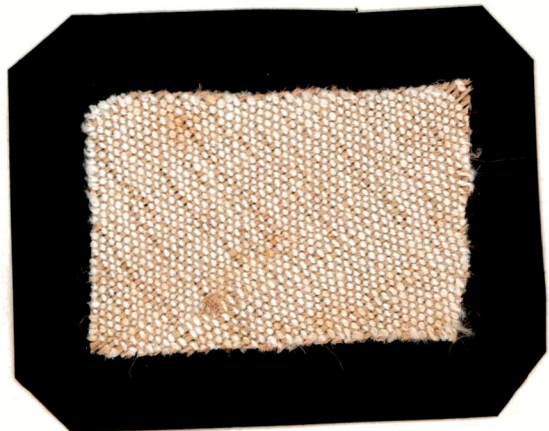
PURE COTTON
ORIGINAL



PURE COTTON
WASHED



COTTON - JUTE
UNION FABRIC
ORIGINAL



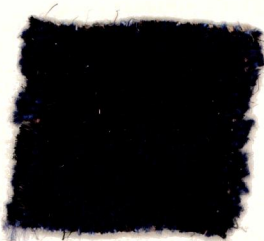
COTTON - JUTE
UNION FABRIC
WASHED

APPENDIX - III

DYED SAMPLES



PURE COTTON

COTTON - JUTE
UNION FABRIC

APPENDIX - IV
 FORMULA USED FOR THE STATISTICAL ANALYSIS OF THE DATA
 OBTAINED IN THIS STUDY

The statistical analysis for the laboratory tests were done by students 't' test.

For testing the hypothesis of two independent random samples of size n_1 and n_2 with means x_1 and x_2 and standard deviation S_1 and S_2 , the following statistic is followed.

$$t = \frac{x_1 - x_2}{S \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}$$

Where,

x_1 = mean of the first sample

x_2 = mean of the second sample

n_1 = number of observations in the first sample

n_2 = number of observations in the second sample

S = combined standard deviation

The value of S is calculated by the following formula

$$S = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$$

FOR EXAMPLE

FABRIC WEIGHT

S. No.	Samples	Mean Weight per square yard in ounces	Loss or gain over original	Percent age loss or gain	't' test	
					Samples compared	Value
1.	Original 100% cotton-A	8.5			AA ₁	2.443
2.	Washed 100% cotton-A ₁	9.2	0.7	8.2	BB ₁	9.0782*
3.	Original cotton Jute union Fabric-B	8.6			AB	0.6393
4.	Washed cotton Jute union Fabric-B ₁	9.9	1.3	15.1	A ₁ B ₁	2.505

* Significant

$$X_1 = 8.5, X_2 = 8.6, n_1 = 4, n_2 = 4$$

$$S_1 = 0.28, S_2 = 0.14$$

$$S = \frac{(4 - 1) \times (0.28)^2 + (4 - 1) \times (0.14)^2}{4 + 4 - 2}$$

$$= 0.2213$$

$$\text{Therefore, } t = \frac{8.5 - 8.6}{0.2213 (1/4 + 1/4)}$$

$$= 0.6393$$

APPENDIX - V

GRAY SCALE USED TO EVALUATE THE DYED SAMPLES

The dyed samples were rated using the AATCC grey scale to measure the extent of colour change and staining. The gray scale ratings envisaged the following standards of colourfastness to naphthol dyes applied to cotton/jute union material.

Number of rating	Inference regarding colour change
5	- No change
4	- Slightly changed
3	- Noticeably changed
2	- Considerably changed
1	- Much changed
	Inference regarding staining
5	- No staining
4	- Slightly stained
3	- Noticeably stained
2	- Considerably stained
1	- Much stained