IKAT DYEING OF BANANA BLENDED FABRIC

By

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B.Sc (H.Sc.)

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CERTIFICATE

Ms K.PRASANTHI DEVI has satisfactorily prosecuted the course of research and that the thesis entitled **IKAT DYEING OF BANANA BLENDED FABRIC** submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the thesis or part thereof has not been previously submitted by her for a degree of any University.

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This is to certify that the thesis entitled **IKAT DYEING OF BANANA BLENDED FABRIC** submitted in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE IN HOME SCIENCE** of the Acharya N.G.Ranga Agricultural University, Hyderabad, is a record of the bonafide research work carried out by **Ms.K.PRASANTHI DEVI** under my guidance and supervision. The subject of the thesis has been approved by the student's Advisory committee.

No part of the thesis has been submitted for any other degree or diploma or has been published. The published part has been fully acknowledged. All the assistance and help received during the course of investigations have been duly acknowledged by the author of the thesis.

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LIST OF CONTENTS

Chapter No.	Title	Page No.
1.0	INTRODUCTION	1-4
2.0	REVIEW OF LITERATURE	5-24
2.1	Extraction of minor vegetable fibres	5-8
2.2	Properties of minor vegetable fibres	8-19
2.3	Processing of minor vegetable fibres	20-21
2.4	Dyeing with natural dyes	21-23
2.5	Uses of banana fibre	24
3.0	MATERIALS AND METHODS	25-48
3.1	Selection of Material	26-29
3.2	Extraction of banana fibre	29-31
3.3	Processing of fibre to yarn	31-36
3.4	Tie dyeing the yarn	36-46
3.5	Weaving	46
3.6	Colour fastness tests	46-47
3.7	Cost calculation	47
3.8	Eliciting consumer opinion	47
3.9	Statistical analysis	48
4.0	RESULTS AND DISCUSSION	49-80
4.1	Colour fastness	50-52
4.2	Cost calculation	52-53
4.3	Subjective evaluation	53-80
5.0	SUMMARY AND CONCLUSION	81-84
	LITERATURE CITED	85-88
	APPENDICES	89-96

LIST OF FIGURES

Fig. No.	Title	Page No.
3.1	Mono colour ikat design.	27
3.2	Double colour ikat design.	28
4.1	Awareness of bast fibre blends.	55
4.2	Suitability of samples for furnishings.	59
4.3	Texture of the samples.	62
4.4	Lusture of the samples.	65
4.5	Drapability of the samples.	69
4.6.1	Colour of the samples.	72
4.6.2	Preference of colour combinations	74
4.7	Preferential ranking based on overall appearance.	78

LIST OF PLATES

Plate No.	Title	Page No.
3.1	Making strips from the pseudostem.	30
3.2	Scraping pith from the strips.	30
3.3	Opening banana fibre.	33
3.4	Carding.	33
3.5	Drawing.	34
3.6	Roving.	34
3.7	Spinning.	35
3.8	Spreading yarn on tie and dye frame.	38
3.9	Tied yarn on tie and dye frame.	38
3.10	Yarn dyed with Natural indigo.	42
3.11	Yarn dyed with Myrobolan flowers and Chawali - kodi.	42
3.12	Winding yarn to the parivattam.	43
3.13	Winding yarn to the bobbin from parivattam.	43
3.14	Weaving.	44

LIST OF TABLES

Table No.	Title	Page No.
2.1	Chemical constituents of banana fibre	10
4.1	Grey scale ratings for colour fastness.	51
4.2	Cost of Production per square metre.	53
4.3	Awareness of blended fabrics of bast fibre origin	54
4.4	Awareness of articles made from banana fibre.	56
4.5	Awareness of ikat dyed fabrics.	57
4.6.1	Suitability of samples for furnishings	58
4.6.2	Statistical analysis of suitability for furnishings between samples.	60
4.7.1	Texture of the samples	61
4.7.2	Statistical analysis of texture between samples	63
4.8.1	Lustre of the samples	63
4.8.2	Statistical analysis of lusture between samples.	64
4.9	Thickness of the samples.	66
4.10.1	Stiffness of the samples.	67
4.10.2	Statistical analysis of stiffness between samples.	67
4.11.1	Drapability of the samples	68
4.11.2	Statistical analysis of drapability between samples.	70
4.12.1	Colour of the samples	71
4.12.2	Statistical analysis of colour between samples.	73
4.12.3	Preference of colour combinations	73

Contd..

Table No.	Title	Page No.
4.13.1	Suitability of designs for furnishings.	75
4.13.2	Statistical analysis of suitability of designs between samples.	75
4.13.3	Size of the design for furnishings.	76
4.14.1	Preferential ranking based on overall appearance.	77
4.14.2	Statistical analysis for preferential ranking based on overall appearance.	78
4.15	Cost of the samples.	80

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DECLARATION

I, **K.PRASANTHI DEVI** hereby declare that the thesis entitled **IKAT DYEING OF BANANA BLENDED FABRIC** submitted to Acharya N.G. Ranga Agricultural University for the Degree of Master of Science in Home Science is the result of original research work done by me. It is further declared that the thesis or part thereof has not been published earlier in any manner.

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ABSTRACT

Banana belongs to the family Musaceae and genus Musa. After harvest of the fruit, fibre could be extracted from the pseudostem which is an agricultural waste and could be used for various textile purposes.

The present study was undertaken to see the suitability of ikat dyed banana blends for furnishings. Banana fibre was blended with viscose rayon in two proportions of 60:40 and 40:60 and two types of yarns in 45 tex were spun on cotton system. Two weft ikat designs suitable for furnishings were evolved. Both the blended yarns were tied according to the designs and dyed with natural dyes (Natural indigo, Myrobolan and Chawali-kodi) as per the designs. Plain weave fabric was woven with 2/20^s cotton yarn as warp and the blended yarn as weft on a frame loom. The fabric samples were tested for their colour fastness properties and cost was calculated. The acceptability of the fabric samples was assessed by a panel of fifty members constituting the post graduate students and staff of Home Science College, ANGRAU, Hyderabad. The collected data was analysed using one way analysis of variance.

Laboratory tests for colour fastness revealed that blue and orange colours had 'excellent' fastness, whereas, yellow colour had 'fair' fastness to sunlight and washing. All the three colours had a better rub fastness in dry condition than in wet condition.

Subjective evaluation revealed that sixty per cent and forty eight per cent of the respondents were aware of blended fabrics of bast fibre origin and articles made from banana fibre respectively. Ikat technique was known to majority of the respondents.

The blended fabrics of banana-viscose in 40 : 60 ratio were graded as fabrics with better lustre, drape and texture hence, better suited to the purpose of furnishings than the 60 : 40 banana-viscose blend. The monocolour with its natural colour combination and its design were preferred to the double colour combination and its design. Among all, the sample with banana-viscose 40 : 60 blend proportion and mono colour design was preferred best because of its better appearance in terms of texture, lustre, drape, colour and design.

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LIST OF ABBREVIATIONS

BIS	-	Bureau of Indian Standards
Ne	-	Newton
gpd	-	Grams per denier
cm	-	Centimetre
μm	-	Micrometer
μ	-	Uneveness
Kg/m^3	-	Kilograms per Cubic Meter
LR	-	Laboratory reagent
mm	-	Millimetre
gm/tex	-	Grams per tex
^0C	-	Degree Centigrade
lts	-	Litres
CSP	-	Count strength product
cc	-	Cubic Centimeter
rpm	-	Rotations per minute
K/s	-	Colour strength value
MLR	-	Material liquor ratio
B60/V40	-	Banana-viscose 60-40
B40/V60	-	Banana-viscose 40-60

Introduction

CHAPTER I

INTRODUCTION

Nature has bestowed upon our country many varieties of trees, shrubs and grasses which yield fibre such as jute, mesta, bhendi, maize, sisal, ramie, pineapple, oil palm, palmyrah and banana. The usage of these minor vegetable fibres dates back to prehistoric times, where the primitive man fabricated coarse cloth from fibres for protection from cold, wind and rain. The usage of banana fibre for textile purposes, predates written history. The evidence of this can be found in epics like Ramayana where Sita and Rama wore "Naravasthra", clothes made from banana fibres.

Phillipines is the premier banana growing country in the world. In India, banana is cultivated in about 1,86,000 hectares of land and the fibre yield is around 7.5 lakh tonnes. The important banana producing states are Kerala, Maharastra, Tamil Nadu and Andhra Pradesh. Many varieties are being cultivated in our country, few of them are poovan, musta, chamba, karpura and chakkarakali.

Banana belongs to the family Musaceae and genus Musa. The term banana fibre is almost a recognised name to connote the species of Musa sapientum which appears both in eastern and western hemisphere. This is also termed as true edible banana. The plants are perennials, and are cultivated in the tropics for fruits. After harvest, the pseudostem has no regular use. It is composed of true stem forming a central core which is tightly encircled by many long sheaths. The true stem on emerging from the leaf sheaths forms the fruit stalk. This stem is used as vegetable by some people. Fibre also can be obtained from the true stem. The stems after harvesting if properly exploited, would yield about 2,00,000 tonnes of fibre valued at Rs.200 million (Shrikantarao, 1985).

The performance of banana fibre points to its future use as a jute substitute if the fibre can be supplied at a cheaper rate using improved extraction techniques. Banana fibre can also be used in paper industry. Its use for fancy articles like hand-bags, purses, cushioning material is already established. It can also be used for making ropes for domestic purposes, for irrigation, transport, coastal shipping and as fine beautiful fabrics.

Need for the study

In order to meet the clothing needs of the fast growing population and changing demands on textile fabrics, supplementing cotton with other fibres is the need of the hour. Secondly, in view of the increasing demand for fibres both within the country and abroad, schemes based on fuller utilization of banana stems will open up opportunities of employment in the rural set up. With the advancement of science and technology, India is able to produce synthetic fabrics, but, these materials are likely to disappear with the termination in the supply of crude petroleum. Therefore,one has to look for alternative natural fibres to meet the demand.

Today "eco-friendly" has become the buzz word in global scenario and eco-friendly fabrics are given paramount importance. The less explored natural fibres belonging to bast and leaf fibre category are now receiving greater importance in this context due to their biodegradable and ecofriendly nature. One such eco-friendly fibres is the versatile banana fibre.

Value addition and diversification are playing vital role in meeting specific requirements and different end-uses. The innovation in fibre, yarn and fabric types assisted by further processing/finishing have brought out marked value addition to textiles. These include various treatments such as bleaching, schreinerising, moiering, embossing, sizing, backfilling, mercerising, dyeing, printing etc. These make the textiles acquire good appearance, texture and performance. Besides these, blending technology helps to make up for certain lacunae in textiles. Therefore blending banana fibre with viscose rayon is expected to improve ease of processing and fabric properties like hand, drape, absorbancy, lustre and fineness as the blended yarns are expected to have desirable properties of both the fibres. The use of cotton yarns in warp direction provides necessary strength and makes the weaving process easy. The texture, strength, absorbancy, drape and other desirable properties are also likely to improve in the blended fabric.

Consumers seek variety which is the back bone of textile industry. To create interest, the yarn can be ikat dyed which is one of India's traditional speciality. Ikats are characterized by a beautiful hazy effect that results when the colours of the ikat dyed yarns merge irregularly into each other. Ikat with natural dyes which are less exploited nowadays would make it interesting and at the same time wholly eco-friendly. With the present national and international awareness of environment, ecology and pollution control, natural dyes appear to be ideal choice since they are non-toxic and can be handled very easily and safely.

The fascinating development of ikat with natural dyes has not been adopted so far on banana blended yarn which is a new development as such to the researcher. Therefore, attempts were made in this direction to weave a material with banana-viscose blended yarn as weft and cotton yarn as warp entitled "Ikat dyeing of banana blended fabric" with the following objectives:

1. To blend banana fibres with viscose rayon in the ratio of 60:40 and 40:60.
2. To tie-dye banana blended yarns.
3. To weave fabric using cotton as warp and banana-viscose rayon blended yarn, dyed with ikat technique as weft.
4. To estimate the cost of finished products.
5. To study the consumer acceptance.

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CHAPTER II

REVIEW OF LITERATURE

A comprehensive review of literature is a must in any research endeavour. The main function of review is to make the research worker upto date with the research carried out in the subject relevant to the present field of study. It unfolds the opinions of many other researchers and scientists regarding an area of study. The present study is new,so both the studies and literature available are limited. Therefore few studies which have some relevance of other ligno-cellulose fibres have been reviewed and presented.

For the purpose of clear exposition of the subject, the available review is dealt under the following heads.

2.1 Extraction of minor vegetable fibres

2.2 Properties of minor vegetable fibres

2.3 Processing of minor vegetable fibres

2.4 Dyeing with natural dyes

2.5 Uses of banana fibre

2.1 EXTRACTION OF MINOR VEGETABLE FIBRES

2.1.1 Extraction of Banana fibre

Shrikantarao (1985) reported that extraction of banana fibre from the stripped leaf was done by hand. The stripped leaf sheath was cut to a size of 0.3 m to 0.4 m long and 0.07 m wide. Scraping was done using blunt blades on a soft wooden plank. Pith was then removed continuously till the fibres appear clean. The fibres were then washed thoroughly, hung up in sunlight to dry.

2.1.2 Date Palm Leaf fibre extraction

Ghosh *et al.* (1993) reported that the date-palm leaf fibre was extracted by mechanical combing process after proper retting of leaves. It could also be extracted by chemical process with decreased retting time wherein, the leaves were immersed in water upto eight days. Due to dissolution of pectin, wax and lignin from leaves, the water became alkaline and coloured. The retted leaves after eight days were mechanically combed and put in ammonium oxalate solution. The dried fibre was bleached in sodium chlorite. The colour of the fibre became more bright and lustrous.

2.1.3 Extraction of Maize fibre

A study conducted by Laga *et al.* (1996) on extraction of maize fibre revealed that, the fibre could be extracted either by retting or by treatment with sodium hydroxide. In the retting process the leaves were kept submerged one to two inches below the surface. The bath contained dirty water and little amount of starch at seven pH. Depending upon the temperature of bath and maturity of the leaf, it would be completed between 12 to 25 days. After retting, the leaves were combed, thoroughly washed and dried.

In the later method the fibres were easily separated from the leaves within few hours. The leaves were boiled with 0.5 per cent NaOH and reflux for one to two hours. After an hour, the leaves were removed and washed in water under pressure. Then the fibre was treated with 0.1 per cent acetic acid to neutralize the alkali and then washed thoroughly and dried. In this method the fibre extracted was only 52 per cent.

2.1.4 Fibre extraction of Palmyrah

According to Shrikantarao (1985), the palmyrah fibre was extracted from the sheath of leaf stalk of palmyrah. Leaf stalks were cut down from the tree and made into small pieces of one to two feet length. These pieces were beaten with wooden hammer to separate the fibre after removal of pith. Fibres were cleaned by combing with an iron comb on a small wooden plank. Finally the fibres were washed thoroughly and dried. Extraction can also be done by retting process. In this process the leaves were immersed in water for eight days and the fibre was drawn.

2.1.5 Fibre extraction from Pineapple leaves

Ramaswamy and Muthukumaraswamy (1994) reported that pineapple leaves are a potential source for fibre extraction. The main principle consists of alternatively beating and scratching of leaves as they were fed at constant rate through a pair of feed rollers. The fibres were extracted mechanically using blunt and crescent shaped knives.

2.1.6 Extraction of Sisal fibre

Mishra *et al.* (1994) analysed the retting behaviour of sisal fibres. It was stated that retting of sisal fibres in acid medium led to more active and oxidisable extracted material with more dissolved ion. Owing to this, the time to extract these fibres is much less. Whereas, retting of sisal fibres in alkaline medium gave more solids in terms of resinous material than acid/neutral medium. It was also reported that separation of resinous substances in neutral water is only partial, even after 20 days of retting. The study also indicated that the fibres extended longitudinally throughout the full length of the leaf where the diameter decreases continuously from root to tip.

2.2 PROPERTIES OF MINOR VEGETABLE FIBRES

2.2.1 Physico-chemical properties

2.2.1.1 Properties of Banana fibre

Sinha (1974b) reported the physical properties of banana, mesta, aloe, manila and sisal fibres. It was stated that the strength of banana fibre was comparable with that of manila and sisal, but aloe fibre was weaker. Banana fibre though, 2.5 times as coarse as mesta was much finer than sisal, whereas aloe fibre compares with sisal and manila in coarseness. Unlike mesta, banana and aloe fibres did not show a meshy structure, their filaments were well separated and were extensible like manila and A sisal. Aloe fibres showed highest extension in wet condition. One important feature of banana fibre was that it was 2.5 times as porous as sisal and other similar fibres. Banana and aloe fibres were much more flexible than manila and sisal. With regard to susceptability to microbial damage, banana fibre could be practically compared with jute, but was more susceptible than sisal and manila fibres.

Reports by Shrikantarao (1985) on the properties of banana fibre revealed that it was twice as coarse as mesta and as strong as jute, but much finer than sisal. The extensibility of banana fibres was two and half times as that of jute. Since banana fibre was more porous it felt soft but owing to its coarser dimensions, its filaments were less pliable than those of jute and mesta. It was lustrous, almost white or light cream colour and took native dyes readily. Banana fibre was similar to that of jute, sisal and other vegetable fibres in the composition of carbohydrate constituents but, it contained a little more of arabinose and mannose. Chemical analysis of the fibre revealed that it contained 61.5 per cent alpha cellulose, 9.7 per cent lignin, 14.9 per cent pentason and 1300 degree of polymerization of alpha cellulose.

As observed by Srikantarao, the X-ray analysis of banana fibre had shown that it had high degree of crystallinity with good alignment of crystals parallel to the fibre axis. The fibre had spiral angle of 30°. The fibre had a true density of 1310 kg/m^3 and apparent density of 620 kg/m^3 with fibre porosity of 35-53 per cent. Electric resistivity of these fibres was found to be 6.5-7.0 x 10^5 cm. The fibre gave a yellow colour with aniline sulphate, a golden yellow colour with iodine and sulphuric acid and blue colour and swelling with ammonical copper.

Bhatia and Gupta (1991) made a study on the physico-chemical properties of banana fibre. The results revealed that the diameter of the fibre ranged between 11-34 um which was similar to the observation made by Chand *et al.* However, the values observed for length of fibre (80-200 cm) were less than the values (90-280 cm) reported by Chand *et al.* This difference in fibre length, might be due to difference in length of the leaf sheaths used. Different values have also been reported for strength, elongation and fineness of the fibre. The values observed for tenacity of the fibre (50-75 gm/tex average) were similar to the reported values. It was also found that the banana fibre was resistant to the action of alkali, phenol, formic acid, chloroform, acetone and petroleum ether. The values observed for moisture, ash, cellulose and lignin content were similar to the values reported in literature by Chand *et al.* (Table 2.1). Similarly the values observed for cold water soluble compounds were also in close proximity.

Table 2.1: Chemical constituents of Banana fibre

Constituents	Percentage by weight	
	Observed value	Reported value
Cellulose	67.63	66.2
Lignin	5.41	5.0
Ash	1.20	1.02
Moisture	8.66	-
Cold water soluble compounds	2.37	2.5
1 per cent NaOH soluble compounds	29.4	28.6

A study conducted by Iyer (1995) on fibre properties of some banana varieties revealed that least work of rupture was shown by Safed velchi which was lower by 50 per cent of the values shown by other fibres. Tensile strength of banana fibres seemed to show significant difference between thick and thin strands in those varieties with low microfibrillar angle. Breaking extension showed good correlation with orientation angle indicating that despiralling occured during tensile loading. Tenacity of fibres coming from different regions along the length and across the radius of a given plant showed little dependance on structural parameters. Tensile strength of different varieties could be related to structural properties.

A study done by Karuna (1996) on physical properties of three varieties of Banana fibres grown in Andhra Pradesh revealed that Robusta variety had more desirable textile properties like high crystallinity, more tenacity, maximum torsional rigidity and also better dye uptake than Bontha and Amruthapani varieties.

2.2.1.2 Properties of Bhendi fibre

Chauhan and Goel (1997a) conducted a study on bhendi fibres. It was observed that bhendi fibres possessed good resistance to acids, phenol, formic acid, dilute alkalies and chloroform at room temperature, but can easily be damaged by concentrated acids and alkalis such as nitric acid, sulphuric acid and sodium hydroxide at room temperature.

2.2.1.3 Properties of Date Palm Leaf fibre

A study by Ghosh *et al.* (1988) on the chemical analysis of date palm leaf fibre indicated that the cellulose content of date palm leaf fibre was little lower than that of sisal. In another study on X-ray analysis of Date-palm leaf fibre, Ghosh *et al.* (1994) reported that the average tenacity and fineness values decreased on treatment with 18 per cent alkali (NaOH) solution. The decrease in strength may be due to breakage of bonds. It was also found that the extension percentage at break increased with the alkali treatment like all other natural vegetable fibres. The degree crystallinity decreased and crystalline orientation deteriorated on alkali treatment.

2.2.1.4 Properties of Jute fibre

Prasad and Shah (1993) were of the view on the chemical reactivity of jute that, when compared with cotton and ramie, jute was more resistant to disintegration by acids due to presence of lignin. However, the delignified jute behaved in a similar way to cotton and ramie. Jute was very sensitive to the action of caustic soda due to the solubilizing action of alkali on jute constituents. The extent of damage depended on the concentration, time and temperature of the treatment. It was also said that the action of hypochlorite on jute varied depending on the pH of the treatment.

2.2.1.5 Properties of Maize fibre

Laga *et al.* (1996) studied the properties of maize fibre and reported that the length of maize fibre varied between six to nine inches. Its linear density varied between 6.47 to 14.47 Ne. Elongation at break of the fibre was very less and between 0.5 to 1.0 per cent. Tenacity was poor and it varied from 1.5 to 3.5 gpd at 4 cm test length. The diameter varied from 0.02 inches to 0.24 inches. These fibres had natural convolutions like cotton and were hygroscopic.

Maize fibres were soluble in concentrated sulphuric acid. Cold and weak mineral acids had no effect. However, boiling with dilute mineral acids lead to hydrolysis. When treated with concentrated NaOH it exhibited the appearance of wool. Maize fibre was coloured yellow by iodine and sulphuric acid.

2.2.1.6 Properties of Oil-palm leaf fibre

Kalyani (1996) conducted a study on properties of oil-palm leaf fibre. The results revealed that oil-palm leaf fibre was long, staple cellulosic fibre and softening had decreased its linear density tremendously. It was also found that tenacity decreased and extension at break increased in case of alkali treated oil-palm leaf fibre. The relative dye uptake also increased after treatment.

2.2.1.7 Properties of Sisal fibre

Experiments were conducted by Paul *et al.* (1972) with the idea of standardising the test methods for agave (sisal) fibres on the characteristics of length, fineness and tenacity. The results indicated that distribution of length of the samples was found to be normal. Though there was a steady decrease in fineness along the length, the overall fineness corresponded to the fineness of the middle point. Except for the bottom portion, tenacity was practically the same along the length and it was found to be the same when tested, on different tensile testing-instruments.

Navinchand and Verma (1990) studied the structure of sisal fibre by X-ray diffraction pattern and compared with other ligno-cellulosic fibres. It was observed that sisal fibre had an additional crystalline peak as compared to jute or sunhemp fibre and was comparable to medium staple of native Egyptian cotton. The main chemical constituents of this fibre were 67 per cent cellulose and 12 per cent lignin. Comparison showed that the lignin content was in the same range as that of jute. Crystalinity index of sisal fibre was found to be 51.2 per cent.

Further it was reported that poly vinylchloride coating of sisal fibre had smoothened the surface and fibre became alkali and moisture resistant. Tensile strength behaviour of coated fibres showed that the coating did not affect the strength of the fibre which showed that the structure of fibre had not been affected. Moisture regain in coated fibre was 4.8 per cent as compared to 11.5 per cent of raw sisal fibre and it was not affected by dipping in 5 per cent NaOH solution.

2.2.2 Yarn properties

2.2.2.1 Properties of Bhendi blended yarns

Chauhan and Goel (1997b) made a study on cotton and bhendi fibres in which they were blended in the proportions of 90-10, 80-20 and 70-30. After blending, rotor spinning system was used for spinning of fibres into yarn. Single ply yarns were prepared from cotton-bhendi fibre blends. Yarn count decreased with increase in proportion of bhendi fibre. Elongation and tenacity of the yarn increased with the increase in proportion of bhendi fibre. The evenness of yarn decreased with increasing proportion of bhendi fibre. Therefore, it has been brought out that expensive fibres can be blended with cheaper fibres which are easily available.

2.2.2.2 Properties of Jute blended yarns

A study was conducted by Sett and Sur (1993) on mechanical behaviour of rotor-spun jute-viscose blended yarns at different twist levels. Viscose fibre of 1.5 denier and 38 mm staple length was used for blending with jute fibre. Raw jute fibre was combed, cut to staple length of 38 mm and then treated with NaOH to make it more flexible and to produce an intimate blend of jute-viscose yarn. Blending of jute with viscose was done at carding stage in 50-50 and 25-75 proportions. The yarns were tested for tenacity, breaking elongation and initial modulus. It was thus concluded that yarn tenacity increased with the decrease in twist and reached a maximum value at the lowest spinnable twist. The yarn breakage elongation first decreased and then increased with increase in twist from its lowest spinnable value.

2.2.2.3 Properties of Mesta blended yarns

Bhavani (1990) conducted a study on suitability of mesta fibre blends for furnishing material. Mesta was blended with polypropylene, pineapple leaf fibre and viscose rayon in two proportions of each namely (i) 75-25 (ii) 50-50. The study revealed that all the yarns had count more than 207 tex. The blended yarn of mesta-polypropylene in 50-50 ratio had higher tenacity and blended yarn of mesta-polypropylene 75-25 had lowest tenacity among the blended yarns. The blended yarns except mesta-polypropylene 50-50 had comparatively less extension percentage.

2.2.2.4 Properties of Pineapple leaf fibre blended yarns

Arora *et al.* (1985) studied the characteristics and processing performance of pineapple leaf fibre by blending pineapple fibre with wool, viscose and polyester waste on experimental basis. The results revealed that the addition of viscose, polyester and wool improved the yarn tenacity and elongation and indicated that about 60 per cent admixture of the pineapple leaf fibre with other fibres made a resonable blend with good strength and evenness. The maximum strength gained in pineapple leaf fibre blends with polyester waste was mainly because of the higher initial modulus of the blend components in comparison with that of other fibres. Viscose, despite having comparatively poor fibre strength, assisted in smooth processing. The strength of pineapple leaf fibre - viscose blend yarn was sufficient for smooth weaving.

2.2.2.5 Properties of Ramie blended yarns

A study was done by Preeti (1989) on the use of blended ramie fibres for furnishing material. Degummed ramie was blended with dyed polypropylene in spinning stage in the following blend proportions 100-0, 80-20, 60-40, 40-60, 20-80 and 0-100. Hundred per cent ramie yarn was stronger than its blends and the strength decreased with the decrease of ramie fibre in the blend. The strength of 100 per cent ramie was same as that of 100 per cent polypropylene. But the blend of 20 per cent ramie showed higher strength than 100 per cent ramie. The blended yarns were also more even when compared to 100 per cent yarns.

Kalita (1996) conducted a study on ramie blended yarns in which ramie was blended with viscose, acrylic and polyester in two different proportions i.e. 50-50 and 60-40. The C.S.P. of all blends was found to be more in case of 50-50 blend proportion. Among all, ramie-polyester blend was found to be higher than the other two blends. Among the three blends turns per inch was found more in case of ramie-polyester blend. It was found that the lea strength of 60-40 blend samples were more than the 50-50 blended yarns in all samples. As compared to all other blends ramie-polyester blend showed higher strength than ramie-polyester and ramie-viscose. As ramie portion in the blend increased, elongation decreased. The uneveness percentage of yarns was found to be highest in case of ramie-acrylic blended yarn and lowest in ramie-polyester blended yarn. The 50-50 blend showed less U per cent than 60-40 blend. The experiment revealed that 50-50 blend yarn had all the properties required for furnishing material.

2.2.3 Fabric properties

2.2.3.1 Properties of Jute blended fabric

Vasantha and Jacob (1993) studied on blending of jute with polypropylene and jute with acrylic in proportions of 20-80 and 40-60 in both the cases. The study revealed that the sample containing 20 per cent jute and 80 per cent acrylic was even, and had more elongation at break and per cent of shrinkage was less when compared to other samples. It was prefered best by the consumers.

2.2.3.2 Properties of Mesta blended fabric

The study by Bhavani (1990) on suitability of mesta blends for furnishing material showed that the fabric made of 50-50 (mesta and others) blended yarns were better than fabrics of 75-25 blended yarn. All the fabrics resisted tearing on Ballistic tester indicating high tear strength. The fabrics had more or less the same count and thickness. The fabric mesta-viscose (75-25) had highest abrasion resistance and the fabric mesta-viscose rayon (50-50) had lowest abrasion resistance. The fabric mesta-pineapple leaf fibre (50-50) had highest warp, weft and fabric strength. Of all the fabrics, the fabrics of 75-25 (mesta-other fibre) blended yarn were with higher stiffness than fabrics of 50-50 blended yarn.

2.2.3.3 Properties of Pineapple leaf fibre blended fabric

Srinathan *et al.* (1990) studied on pineapple blended fabric processed on cotton system. The pineapple leaf fibre-cotton blended fabric was compared with control cotton fabric for strength, elongation, abrasion resistance and flame retardency properties. It was found that there was significant difference in strength, elongation and shrinkage between two fabrics. Pineapple leaf fibre-cotton blended fabric had less abrasion resistance when compared to control cotton fabric. Like cotton, the pineapple-cotton blended fabric showed good retention of strength and good flame retardency properties. It was concluded that, to upgrade the spinning potential without much loss in fabric strength, the best blend composition was 20-80 pineapple leaf fibre-cotton.

2.2.3.4 Properties of Ramie blended fabric

Preeti (1989) conducted a study on the use of blended ramie fibres as furnishing material. Ramie was blended with polypropylene in proportions of 100-0, 80-20, 60-40, 40-60, 20-80 and 0-100. It was found that blended fabrics had better properties than 100% fabrics. Among the blends 20 per cent ramie fabric showed better qualities in all the characteristics namely, abrasion resistance, tear strength, crease recovery angle and stiffness.

2.3 PROCESSING OF MINOR VEGETABLE FIBRES

2.3.1 Softening

2.3.1.1 Softening of Banana fibre

According to Shrikantarao (1985) spinning performance will be best by softening i.e., when sprayed with a batching oil-water emulsion limited to six per cent oil on the weight of the fibre piled for 72 hours.

2.3.1.2 Softening of Jute

A study was made on different parameters of jute softening by Banerjee *et al.* (1992). It was found that 16 pairs of softener rollers were required instead of 48 pairs in conventional machine and the piling hours were reduced from 48 to 24 hours which had no detrimental effect on spinning performance.

2.3.1.3 Softening of Mesta

A study conducted by Jyothirmai and Jacob (1997) on softening of mesta fibre indicated that softening with NaOH followed by softening with $Zncl_2$, teepol and turkey red oil resulted in bright colour, more dye uptake, better lustre and bright overall appearance. Whereas, in terms of texture it was better with teepol and turkey red oil, followed by NaOH and $Zncl_2$.

2.3.2 Blending

Ghosh *et al.* (1982) conducted a study on processing of pineapple leaf fibre in cotton machinery. It revealed that spinning of stapled pineapple leaf fibre by itself on cotton spinning system was not possible. But there was a feasibility of producing blended product from cotton-pineapple leaf fibre in cotton machinery using low proportion (below 50%) of pineapple leaf fibre in composition. The spinning performance of blended product was poor, it was also reflected in the cotton-pineapple leaf fibre product. But, there was scope for utilizing the product for some specialised uses.

2.4 DYEING WITH NATURAL DYES

A study was conducted by Udayini and Jacob (1988) on the development of new vegetable dyes for Kalamkari painting. Dyes were extracted from annato seeds, indigo and sappan wood which gave orange, blue, garnet and lavender colours. The colour fastness tests with regard to overall efficiency revealed that blue had the best colour fastness followed by orange, garnet and lavender. Blue colour showed fair resistance to washing, sunlight, crocking, perspiration and pressing. Orange had poor fastness to sunlight. Garnet and lavender had poor resistance to perspiration.

A study on substitute of myrobolan as mordant, conducted by Gupta (1990) revealed that it can be substituted with any other vegetable that has tannic acid. The study further revealed that myrobolan can be substituted with pomogranate rind which gave more deeper shades with equal colour fastness. It was also found that pomogranate rind gave new shades which were not possible with myrobalan.

Pandhye and Rathi (1990) studied the effect of mordants on dyeing of cotton with vegetable dyes and found that myrobalan mordant when used in combination with each of the six mordants (Alum, Al_2SO_4, $Sncl_2$, $K_2Cr_2O_7$, $CuSO_4$, $FeSO_4$) used for vegetable dyeing, influenced the dye uptake in case of vegetable dyes, Maddar and Chawali-kodi.

Gulrajani *et al.* (1992) studied on natural yellow dyes. Dyeing wool and silk with myrobolan's extract with and without addition of metallic salts showed that it gave yellow colour on silk with alum, chrome and tin mordant, yellow brown with copper and black with iron salts. The colours were slightly different on wool, being yellow ochre with alum, olive green with copper and chrome, brown with iron, beige with tin and pale yellow without any mordant.

Nishida and Kobayashi (1992) made a study on dyeing properties of the natural dyes from vegetable sources. Fastness tests were carried out on mordanted silk, cotton and sillook blended fabrics. The results lead to the conclusion that the light fastness of Kariyasu was very high when compared to Akon and Ouren.

Paul *et al.* (1996) investigated the classification, extraction and fastness properties of natural dyes. It was found that yellows were rendered susceptible to light because they emit flourescence. The fading of the yellow dyes was attributed to the inherent tendency of the flavonoids to form quinones on exposure to sunlight. Wash fastness of yellow dyes ranged from fair to excellent. Blue colour among natural dyes could be obtained only from indigo. It was found to have excellent light fastness and wash fastness.

Chinchwade *et al.* (1997) studied the dyeing of jute fabrics with natural dyes and revealed that 100 per cent jute dyed with Turmeric or Catechu showed higher K/S value than jute-cellulosic blends. Five per cent tannic acid plus 10 per cent citric acid was the best result in case of jute and its blends dyed with Turmeric. Five per cent tannic acid plus five per cent $FeSO_4$ gave better result in case of dyeing of jute and its blends dyed with Turmeric. In case of dyeing of jute and its blends with Catechu the optimum result was obtained either with 20 per cent citric acid or 20 per cent $FeSO_4$ opined the authors.

Gogoi *et al.* (1997) studied natural dyes on silk and revealed that indigo dyed samples had better wash fastness, good fastness to both dry and wet pressing and excellent light fastness.

Dedhia (1998) studied the sequestering agents to improve the fastness properties of natural dyes. Hundred per cent cotton fabric was premordanted with myrobolan and was dyed with two dyes Haldi and Chawali-kodi and the samples were treated with sequestering agents. Sequestering agents lowered the dye uptake of both Haldi and Chawali-kodi. They improved the day light fastness and wash fastness but maintained the perspiration fastness and rub fastness of the sample dyed with both dyes.

2.5 USES OF BANANA FIBRE

Sinha (1974a) reported that banana fibre could be used as a substitute for jute and can be blended with jute and mesta.

Gosh (1981) opined that banana fibre can be blended with jute and mesta for a finer yarn.

As reported by Shrikantarao (1985) the high cellulose content, degree of polymerisation of alpha cellulose and fibre dimension values indicate that banana fibre could be used as a cellulosic raw material for paper and other industries.

Satyanarayana *et al.* (1986) stated that various consumer goods could be produced using coir/banana-cotton fabric reinforced polyester composites.

Doraiswamy (1991) opined that banana fibres were too coarse for fabric applications, but were suitable for the manufacture of plaits or baskets.

Holiday (1992) studied that, unique non wovens could be produced from banana and other minor vegetable fibres.

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Materials and Methods

CHAPTER III

MATERIALS AND METHODS

The study was proposed to blend banana fibre with viscose rayon in two blend ratios, ikat dye the blended weft yarn in two colours and designs in each blend ratio and to weave weft ikat fabrics with cotton as warp. It was also proposed to elicit consumer opinion by subjective evaluation. Colour fastness properties of the woven samples were assessed.

Different aspects of materials and methods adopted for carrying out the study forms the subject matter of this chapter and is presented under the following heads.

3.1 Selection of material

3.2 Extraction of banana fibre

3.3 Processing of fibre to yarn

3.4 Tie dyeing the yarn

3.5 Weaving

3.6 Colour fastness tests

3.7 Cost calculation

3.8 Eliciting consumer opinion

3.9 Statistical analysis

3.1 SELECTION OF MATERIAL

3.1.1 Selection of fibres

Three fibres banana, viscose and cotton were selected for the present study.

Banana fibre of the variety Robusta, selected for the study was procured from Krishi Vigyan Kendra of Kalavacharla, at Rajahmundry. Robusta variety was selected because it had more desirable textile properties such as good tenacity, better absorbency, fair torsional rigidity and satisfactory dye uptake (Karuna, 1997).

Staple viscose rayon was selected to be blended with banana fibre because of its cellulosic nature, lustre and ease of spinning in the cotton system.

Cotton was selected for warp in order to contribute to the strength of the fabric as the banana-viscose blended yarn showed lower strength. However, it is a common practice to have cotton yarn as warp in furnishings.

3.1.2 Selection of designs

New weft ikat designs suitable for furnishings were evolved keeping in view the present trends. The designs to be developed on the fabric were first prepared on a graph showing all colours. Two designs - one of single colour and the other of double colour were selected for the ikat -

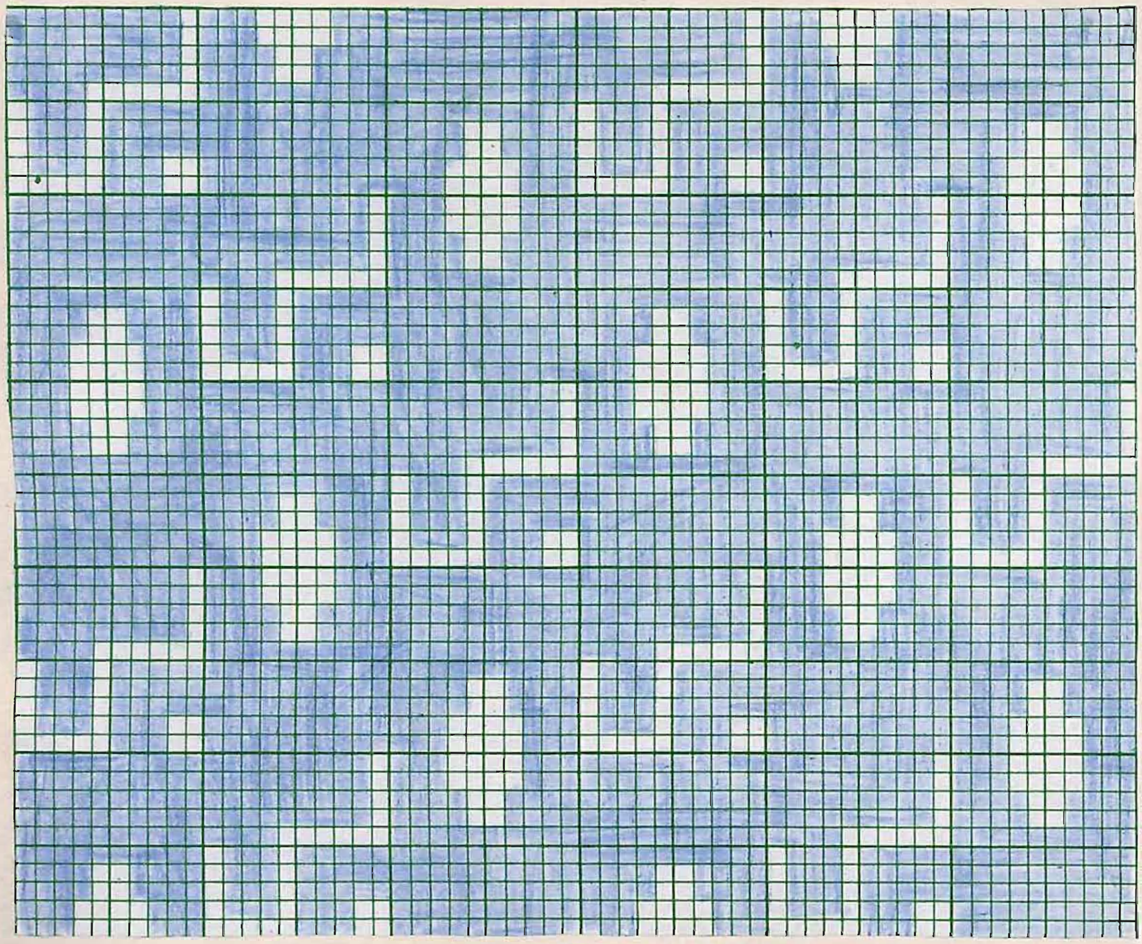

FIG.3.1: MONO COLOUR IKAT DESIGN

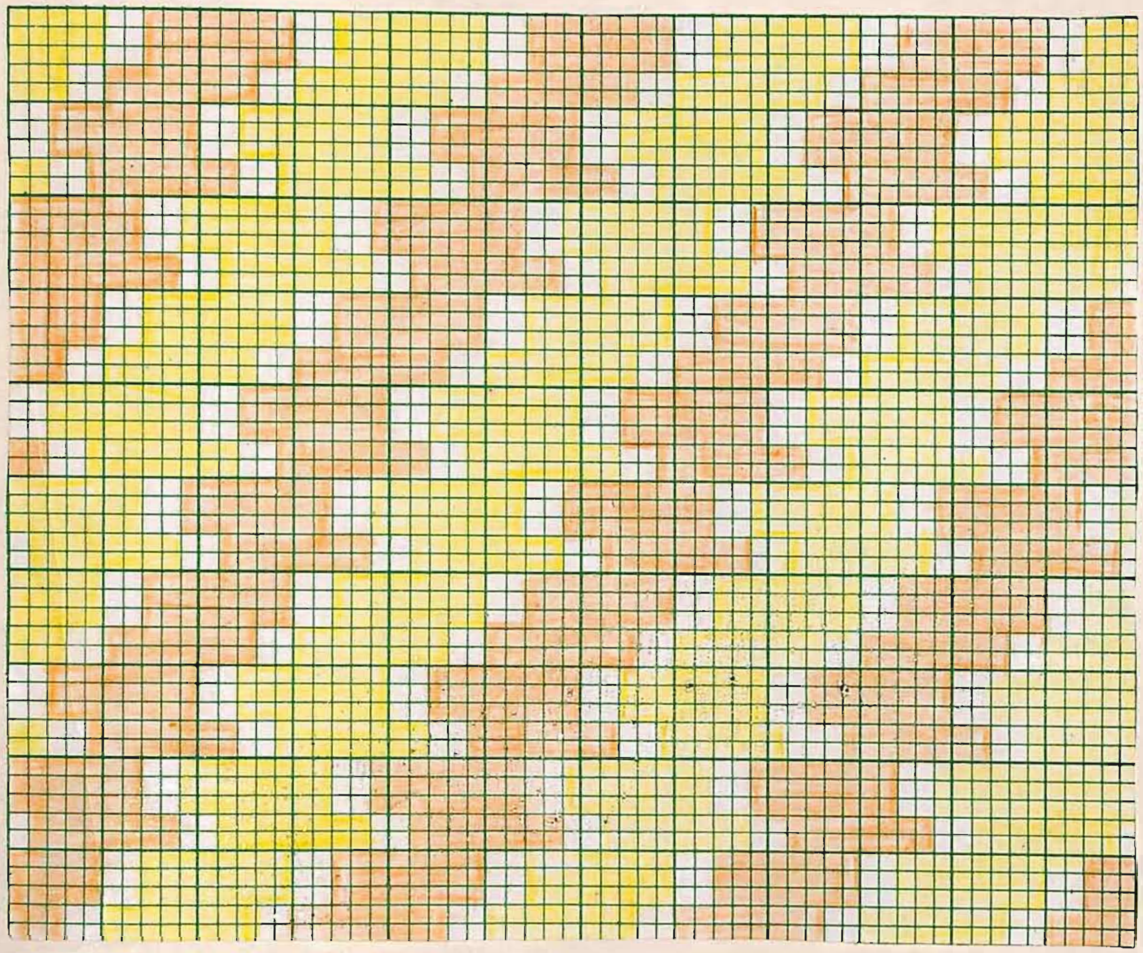

FIG.3.2 DOUBLE COLOUR IKAT DESIGN

dyeing of blended yarns, based on their suitability for ikat dyeing (Fig.3.1 and 3.2).

3.1.3 Selection of dyes

With growing concern over eco-friendliness the use of bio-degradable materials had become imperative. Therefore, for the present study natural dyes which were considered not only to be eco-friendly but also known for their excellent endurance and soft lustrous colouring were selected.

Indigofera tinctoria (Natural indigo) popularly known as the 'king of natural dyes' was used for the design of single colour. Terminalia chebula (Myrobolan flowers) and Chawali-kodi were selected for the double colour design.

3.1.4 Selection of chemicals

Chemicals of L.R. grade were selected for the purpose of dyeing.

3.2 EXTRACTION OF BANANA FIBRE

The fibre was obtained from the pseudostem of the plant which was comprised of leaf sheaths called stalks. The extraction of fibre from the leaf sheaths was done by hand which was an established method (Srikantharao, 1985). Hand extracted fibre was found to be superior (bright and lustrous) than machine extracted fibre which had less strength and was dull in appearance. Thus to obtain the fibre, strips of 2-3 feet length

PLATE 3.1 MAKING STRIPS FROM THE PSEUDOSTEM.

PLATE 3.2 SCRAPING PITH FROM THE STRIPS.

were cut and blades were used to scrape off the pith placing on a wooden plank (Plate 3.1 and 3.2). Then the fibre was rinsed thoroughly in water, dried in shade and combed.

3.3 PROCESSING OF THE FIBRE TO YARN

3.3.1 Blend ratio

Two blend ratios 60:40 and 40:60 of banana fibre with viscose rayon were selected for the study. These blend ratios were selected because of their common occurance in other blended fabrics. Blending was done at Institute of Jute Technology, Calcutta. From the two types of blends, single yarns of 45 tex were spun on cotton system following the standard procedure developed by Institute of Jute Technology (Appendix I).

3.3.2 Softening of banana fibre

Banana fibre being coarse and stiff was softened by oil water emulsion to make it pliable and manageable for processing. Oil water emulsion was prepared by mixing mineral oil and water in the ratio of 6:94. Banana fibres were evenly sprayed with the oil emulsion of 25 per cent by weight of fibre and kept in air tight bins for 24 hours. This process is referred to as 'piling'. After piling, the treated fibre was processed and blended (Institute of Jute Technology).

3.3.3 Stapling

A miniature stapling machine was used to cut banana fibre into a staple length of 44 mm which was same as that of the viscose staple fibre.

3.3.4 Opening

Stapled banana fibres were passed into a miniature opening frame. Opening was done to seperate the fibres and also to remove trash (Plate 3.3). Viscose fibres were opened by hand which helped in better blending.

3.3.5 Carding

Blending was done at carding stage. A miniature carding frame was used for the purpose, which had an intake of only 40 gms at a time (Plate 3.4). For the formation of 60:40 banana-viscose rayon blend, 24 gms of banana fibre and 16 gms of staple viscose fibre was weighed and used for blending. Similarly 16 gms of banana fibre and 24 gms of viscose rayon were weighed and used for 40:60 banana-viscose-rayon blend. A layer of viscose rayon was sandwiched between layers of banana fibre and fed into the machine. Laps of 60:40 banana-viscose blend and 40:60 banana-viscose blend were obtained by this process.

3.3.6 Drawing

The laps from the carding frame were fed into a miniature drawing frame (Plate 3.5) which could accomodate six slivers at a time. Drawing was done thrice to ensure proper blending. The sliver thus obtained from drawing was collected into bins.

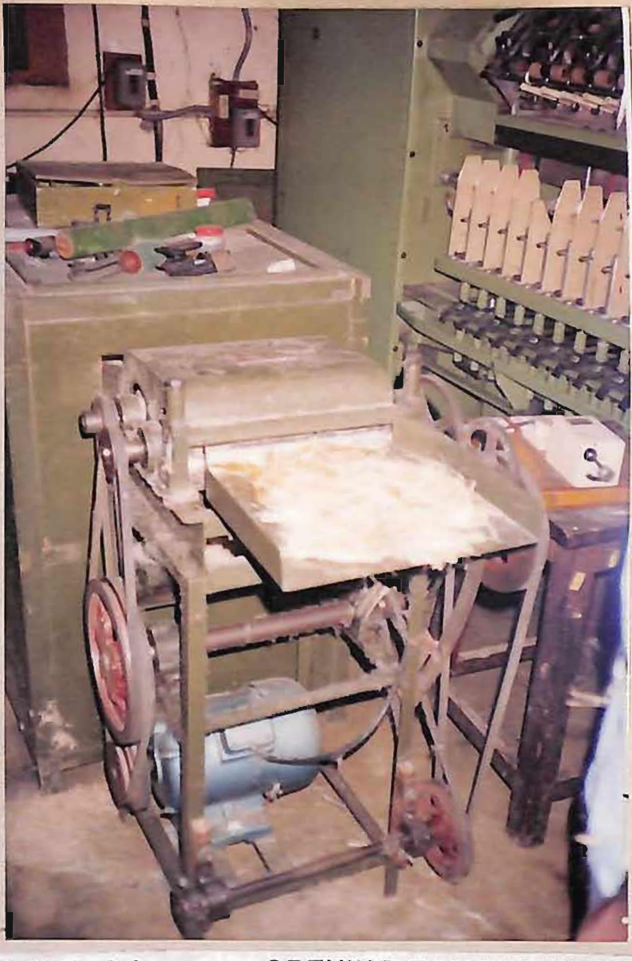

PLATE 3.3 OPENING BANANA FIBRE.

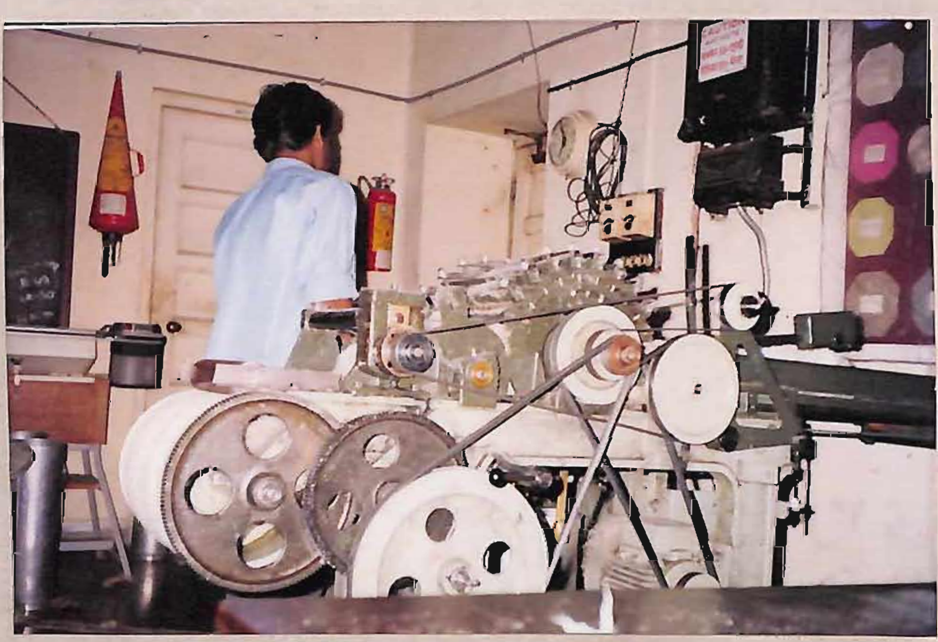

PLATE 3.4 CARDING.

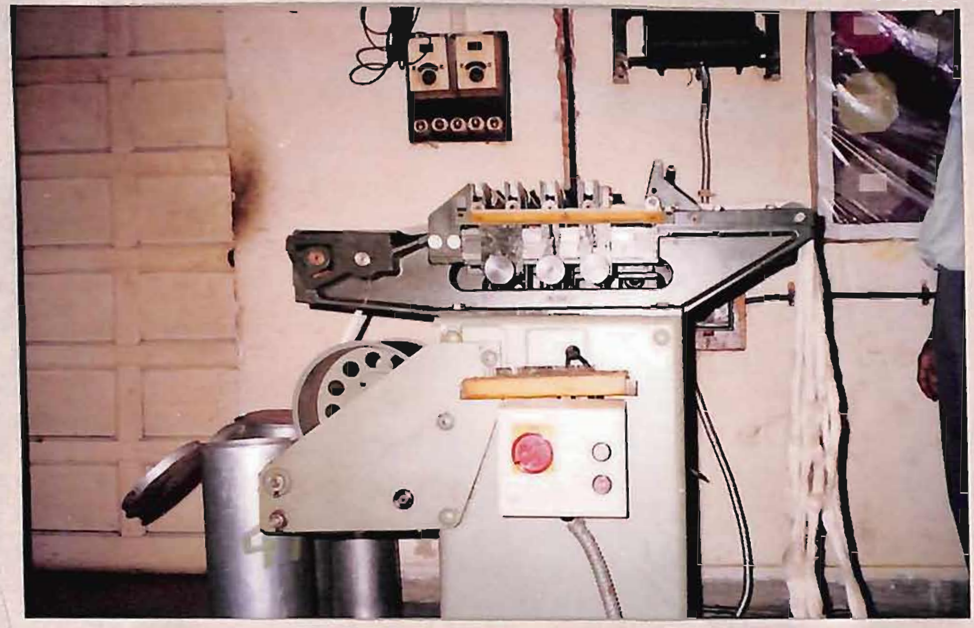

PLATE 3.5 DRAWING.

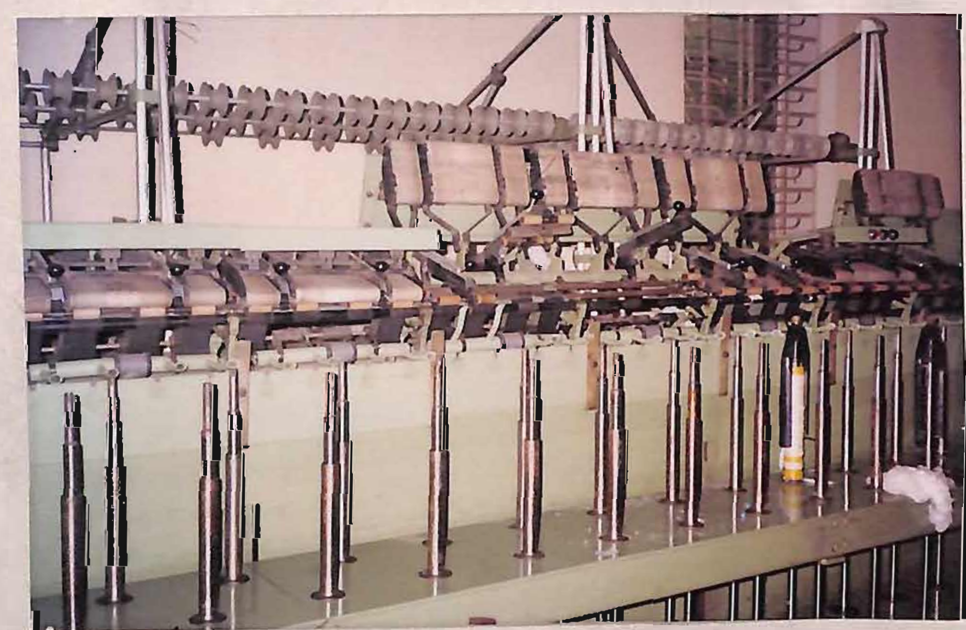

PLATE 3.6 ROVING.

3.3.7 Roving

The drawn sliver when fed into the roving frame (Plate 3.6) produced roving sliver of pencil thickness wound on spools. The spools were then passed to the spinning frame.

3.3.8 Spinning

Spinning was done on ring frame, the speed of which was 7700 rpm. At this stage twist was imparted. The single yarn thus formed was wound onto small spools. From the spools the yarn was wound onto cones with the help of a yarn winding machine (Plate 3.7).

3.4 TIE DYEING THE YARN

3.4.1 Preparation for dyeing

The blended yarn from the cones was wound in the form of hanks using hank winder. The hanks were then scoured as per the procedure suggested by Marsh (1979).

Scouring

Recipe (for 1 kg material)

Sodium carbonate	..	10 gms
Neutral soap	..	20 gms
Material Liquor ratio	..	1 : 30

The purpose of scouring was to make the yarn suitable for dyeing of even shades. The yarn was scoured for 30 minutes in the scouring solution. The scoured yarn was dried and then wound on to tin bobbins using hand winding charka.

3.4.2 Spreading the yarn on tie and dye frame

An adjustable tie and dye frame that had nails on either side was used for the purpose. Depending on the width of the fabric, the frame was adjusted leaving allowance for shrinkage. The yarn from the tin bobbins was wound around the nails from one end to other end of the frame with the help of a thread guide (Plate 3.8). The number of lines in each repeat of the design on the graph sheet was equal to the number of nails around which the yarn was wound. The yarn was wound four times from end to end on each pair of nails to form eight picks in each group of yarns. Thus one horizontal line on the graph sheet was equal to eight picks on the fabric. The number of picks in each set of yarns was decided based on the size of the design intended to weave.

3.4.3 Marking the yarns

A twine thread of fabric width was taken and it was marked at equal distances of two-tenth of an inch. The graph sheet ccnsists of ten units in an inch therefore, the size of the design from the graph sheet was doubled widthwise on the fabric. The marking thread was placed on the first set of nails and the first group of yarns were marked as per the design using charcoal paste. The thread was then shifted onto the

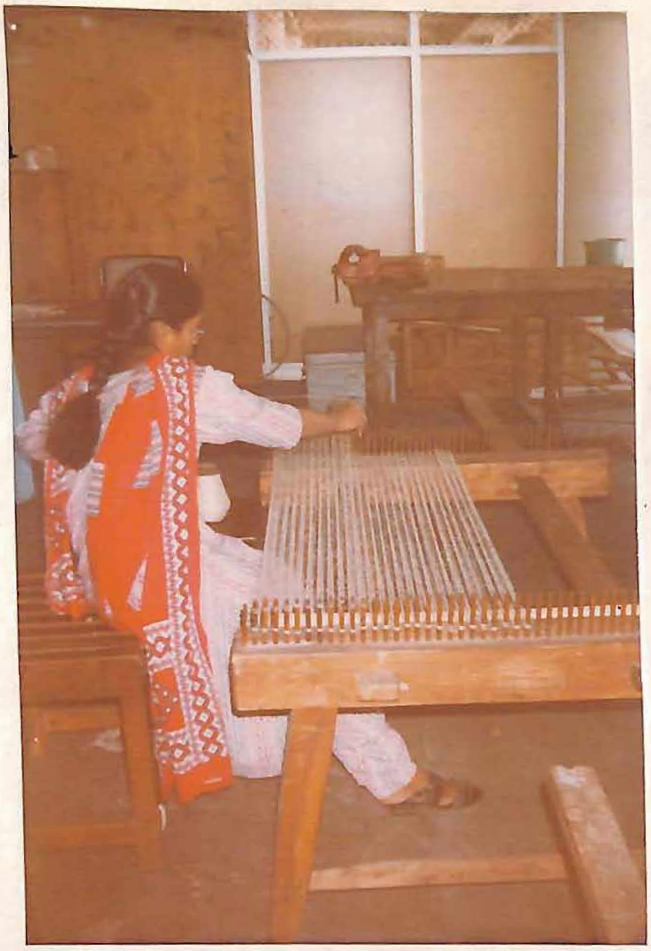

PLATE 3.8 SPREADING YARN ON TIE AND DYE FRAME.

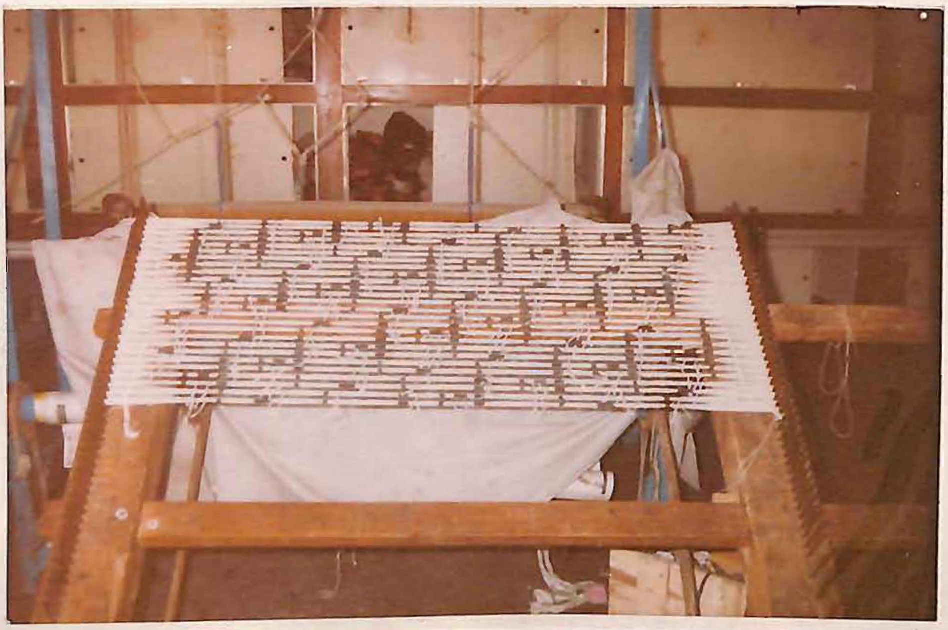

PLATE 3.9 TIED YARN ON TIE AND DYE FRAME.

second set of nails and so on till all the groups of yarn on the frame were marked.

3.4.4 Tieing

3.4.4.1 Tieing for single colour design

As per the design marked, the yarn was tied with thick thread or rubber bands (cut from cycle tube) in the places where natural colour of the yarn has to be retained (Plate 3.9). It was then kept ready for dyeing with natural indigo which was described later in this chapter.

3.4.4.2 Tieing for double colour design

The yarn which was to be dyed with double colour was first tied at areas where the natural colour of the yarn was to be retained. It was then kept ready to be dyed with Myrobolan flowers. The dyed yarn was dried and was once again spread on the tie and dye frame. The yarn was tied again according to the design wherever the yellow colour was to be retained and thus made ready for second dyeing with Chawali-kodi.

3.4.5 Dyeing

Dyeing is the process where the fibre,yarn or fabric is impregnated with the dyestuff.

3.4.5.1 Dyeing with natural indigo

Recipe (for 1 kg material)

Natural Indigo	..	50 gms
Turkey red oil	..	50 cc
Sodium hydroxide	..	100 gms
Sodium hydro sulphite	..	100 gms
Material liquor ratio	..	1:20.

Dyeing procedure

One of the natural dyes that had affinity for cellulosic fibres was the natural indigo. Hence, it was used without any mordant. The dye was made into paste with the addition of turkey red oil which aids in even distribution of dye in water. Three to four litres of water was added. Measured amount of sodium hydroxide and sodium hydro sulphite were added to aid in proper solubility in water and to reduce the dye respectively. This mixture was stirred well and heated to 50°C and left for 10-15 minutes till the dye showed colour change indicating that it was reduced. To prepare the final dye bath, the rest of the amount of water (15-17 lts) as per the recipe was added to the already prepared solution. The dye bath was set up with 1:20 material liquor ratio at room temperature.

The presoaked material to be dyed was entered into the dye bath. It was stirred well for three to five minutes and squeezed, then oxidised in open air for five minutes. This process was repeated five to six times. The depth of the shade increased with each dip. After dyeing the material was washed well in plain water several times. The material was then soaped in water at room temperature with one gm per litre soap for five minutes, to remove the loose dye particles on surface of the material. The yarn was then washed well and dried under shade (Plate 3.10).

3.4.5.2 Dyeing with Myrobolan flowers and Chawali-kodi

Pre-Mordanting

Cellulosic material do not have affinity for basic dyes and since chemically all vegetable dyes are similar to basic dyes, mordanting was done (Gupta, 1990).

Recipe for Pre-Mordanting (for 1 kg material)

Myrobolan fruit powder	..	200 gms
Potassium aluminium sulphate	..	100 gms
Material liquor ratio	..	1:15.

Procedure

The established Kalamkari procedure developed by Weavers' Service Centre, A.P. was followed for mordanting and dyeing of the yarns. Myrobolan fruit powder was made into a smooth paste with little water. Potassium aluminium sulphăte was dissolved separately in water (if needed by boiling) and was mixed with the paste. The bath was made upto a material liquor ratio (MLR) of 1:15 at 50°C. The yarn was entered into the

PLATE 3.10 YARN DYED WITH NATURAL INDIGO.

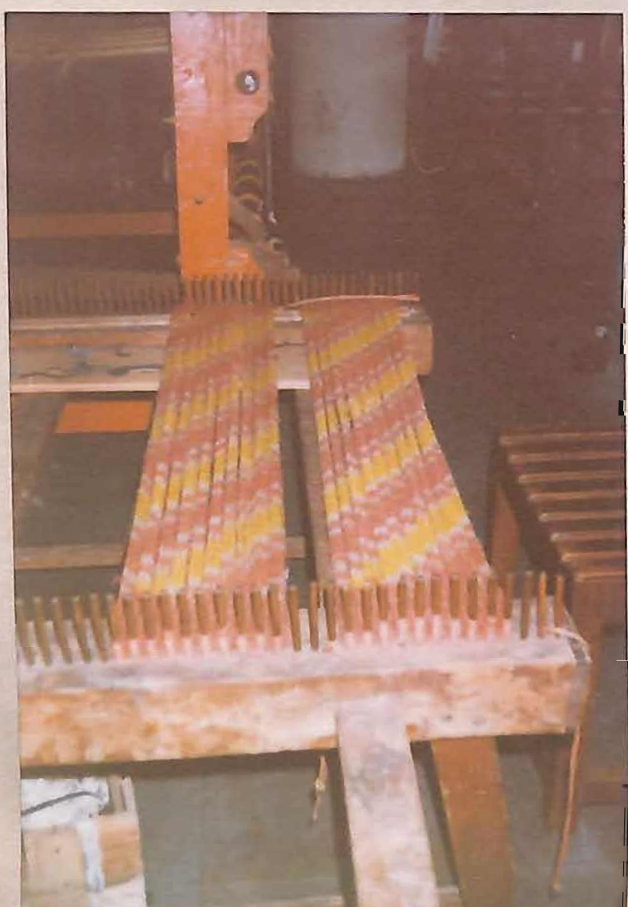

PLATE 3.11 YARN DYED WITH MYROBOLAN FLOWERS AND CHAWALI - KODI.

bath and it was worked for 15-20 minutes. It was then rinsed, squeezed and dried without washing.

Recipe for dyeing

(For 1 kg material)

1st dye bath :

Myrobolan flowers	..	125 gms
Material liquor ratio	..	1:20

2nd dye bath:

Chawali-kodi	..	125 gms
Material liquor ratio	..	1:20.

Dyeing procedure

Myrobolan flowers were powdered and boiled in water three to four times to get its extract. A dye bath was set up with 1:20 material liquor ratio at 50°C. The extract was added by filtering into the dye bath and was then mixed well. The premordanted yarn was washed in water at room temperature to remove excess of mordant. The washed yarn was put into the dye bath and worked. Slowly the temperature was raised to boiling point. Total dyeing time taken was 45 minutes.

After dyeing, the yarn was washed thrice and dried in shade. The yarn was tied again for second colour as described earlier and the procedure of dyeing was repeated for the second dye i.e., chawali-kodi which gave orange colour on yellow colour of Myrobolan flowers (Plate 3.11).

PLATE 3.12 WINDING YARN TO THE PARIVATTAM.

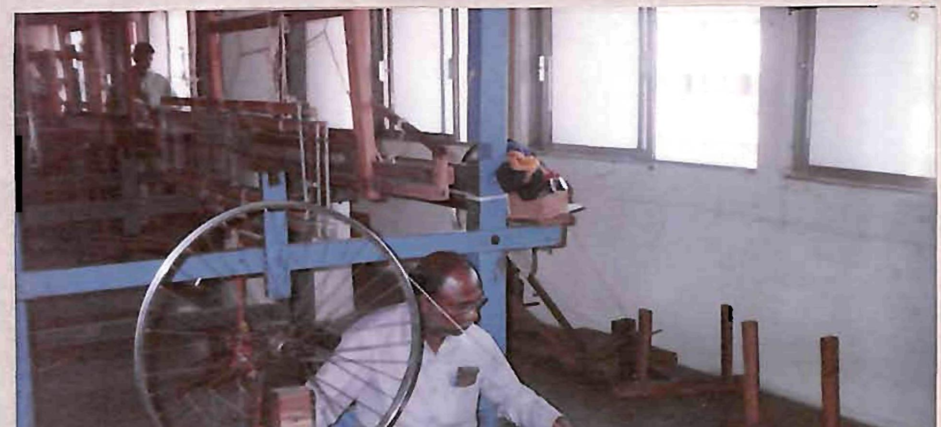

PLATE 3.13 WINDING YARN TO THE BOBBIN FROM PARIVATTAM.

PLATE 3.14 WEAVING.

3.4.6 Post dyeing process

The dried yarn was once again spread on the tie and dye frame. All the tieings were removed. The weft yarn from the frame was wound on to parivattam and from it to bobbins with the help of charka (Plates 3.12 and 3.13). The bobbins were kept in serial order to facilitate weaving in the required order.

3.5 WEAVING

Weaving was done on a treadle type handloom which was commonly called as frame loom (Plate 3.14). Reed of 40 Nos. was used for the purpose of beating. Two warp yarns were threaded through each dent of the reed for a closer weave. Plain weave fabric with 32 picks per inch was woven with white cotton yarn of 2/20s count as warp and the ikat dyed banana-viscose rayon blended yarn of 45 tex as weft. While weaving, care was taken for each picking to ensure the formation of design on the cloth as anticipated without any disorders. The samples thus prepared were given in Appendix I.

3.6 COLOUR FASTNESS TESTS

Laboratory tests were done to test the colour fastness properties of the natural dyed fabrics.

Colour fastness test to washing was conducted using a laundrometer following the procedure IS:687-1979. The samples were evaluated for colour change and staining using grey scale following BIS test procedure IS:768-1956 and IS:769-1956 respectively.

Crockmeter was used to test the rub fastness following the test procedure IS: 766-1956. The undyed fabrics (wet and dry) were assessed for transference of colour using grey scale for staining following BIS test procedure IS: 769-1956.

Colour fastness test to sunlight was conducted following the test procedure IS: 686-1957 and the samples were evaluated using grey scale for colour change following test procedure IS: 768-1956.

3.7 COST CALCULATION

The cost of production of the fabric was calculated taking into consideration the cost of fibres, blending charges, cost of tie dyeing and weaving.

3.8 ELICITING CONSUMER OPINION

To find out the consumer opinion on the produced fabrics, a schedule was prepared. A sample of 50 was selected which constituted post-graduate students and staff of Home Science college. A schedule was prepared to elicit information regarding the awareness of blended fabrics of bast fibre origin and articles made from banana fibre. Fabric properties like texture, thickness, drapability, stiffness, lustre, colour combinations and cost of samples were judged by the subjects using the schedule (Appendix II).

3.9 STATISTICAL ANALYSIS

The data obtained from subjective evaluation was consolidated and analysed statistically using simple percentages and one way analysis of variance. Analysis of variance (one way classification) was used to find out significant difference between the samples with respect to characteristics such as texture, drape, lustre, colour and overall appearance (Nageshwara Rao, 1983).

F value was calculated by using the following formula.

$$F = \frac{X'_1}{X'_2}$$

X'_1 = Mean sum of squares

X'_2 = Mean sum of squares of error.

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Results and Discussion

CHAPTER IV

RESULTS AND DISCUSSION

The study was planned to blend banana fibre with viscose rayon in two proportions. It was intended to weave four different fabric samples with two ikat designs in each ratio. All the samples were woven with hundred per cent cotton as warp and the blended ikat dyed yarn as weft. The four fabric sample were

Code	Blend proportion of weft yarn	Colour
A	Banana : Viscose 60 : 40	Single colour
B	Banana : Viscose 60 : 40	Double colour
C	Banana : Viscose 40 : 60	Single colour
D	Banana : Viscose 40 : 60	Double colour

The study was also intended to know the colour fastness properties, to calculate the cost of production and to elicit consumer opinion. The findings of the study are discussed in this chapter under the following heads.

4.1 Colour fastness

4.2 Cost calculation

4.3 Subjective evaluation

4.1 COLOUR FASTNESS

4.1.1 Colour fastness to sunlight

The fabrics were assessed for colour fastness to sunlight, the results of which are given in Table 4.1.

The blue colour of samples 'A' and 'C' and orange colour of Sample 'B' and 'D' showed 'excellent' colour fastness with a rating of 5. Yellow colour of 'B' and 'D' samples had a 'fair' fastness to sunlight with a rating of 3 on grey scale for colour change (Gogoi, 1997).

4.1.2 Colour fastness to washing

The colour fastness to washing revealed that there was no loss of colour in indigo dyed samples ('A' and 'C') however, the colour deepened. When they were compared with grey scale for staining, both were rated as 4/5 which means that very slight staining was found. With regard to colour change, the double coloured samples 'B' and 'D' were considered to have 'excellent' and 'fair' colour fastness to washing for orange and yellow colours respectively with ratings of 5 and 3. When compared with grey scale for staining, all the samples showed very slight staining as they were rated as 4/5. This clearly indicated that natural dyes used for the experiment were washfast. Similar results were reported by Paul (1996).

Table 4.1: Grey scale ratings for colour fastness

Sample	Colour	Sunlight	Washing		Crocking	
		Colour change	Colour change	Colour staining	Wet colour staining	Dry colour staining
A	Blue	5	Deepened	4/5	3/4	4/5
B	Orange	5	5	4/5	3/4	4/5
	Yellow	3	3	4/5	3/4	4/5
C	Blue	5	Deepened	4/5	3/4	4/5
D	Orange	5	5	4/5	3/4	4/5
	Yellow	3	3	4/5	3/4	4/5

4.1.3 Colour fastness to crocking

The colours used on all samples namely blue, orange and yellow showed very slight staining with a rating of 4/5 for dry crocking and slightly noticeable staining was found for wet crocking with a rating of 3/4.

Overall, the colour fastness of the samples A, B, C and D were found to be satisfactory for intended end use i.e., furnishings (Table 4.1).

4.2 COST CALCULATION

The table on production cost (Table 4.2) gives a picture that all four samples had the same range of production costs. However, sample 'A' costed Rs.41.30 and sample 'C' costed Rs.41.70 which were low when compared to the other samples. Sample 'B' and 'D' were found to have a production cost of Rs.46.10 and Rs.46.30 respectively. The results revealed that samples 'A' and 'B' inspite of being of same blend proportion, 'B' was costlier than 'A' because of the additional tieing and dyeing charges. The same reason holds good for 'C' and 'D' samples.

Table 4.2: Cost of Production per square metre

Particulars	A	B	C	D
Weight of the fabric g/m²	221.6 gms	221.6 gms	212.0 gms	212.0 gms
Cost of cotton yarn Rs.100/kg	Rs.11.08	Rs.11.08	Rs.10.60	Rs.10.60
Cost of banana fibre Rs.20/kg	Rs. 1.33	Rs. 1.33	Rs. 0.85	Rs. 0.85
Cost of viscose rayon Rs.80/kg	Rs. 3.55	Rs. 3.55	Rs. 5.09	Rs. 5.09
Cost of blending	Rs. 5.00	Rs. 5.00	Rs. 5.00	Rs. 5.00
Cost of tieing	Rs. 8.00	Rs.12.00	Rs. 8.00	Rs.12.00
Cost of weaving	Rs.12.00	Rs.12.00	Rs.12.00	Rs.12.00
Cost of dyeing Rs.2/kg	Rs. 0.22	Rs. 0.44	Rs. 0.02	Rs. 0.04
Cost of dyes	Rs. 0.14	Rs. 0.72	Rs. 0.14	Rs. 0.69
Total cost	Rs.41.30	Rs.46.10	Rs.41.70	Rs.46.30

It was evident from the table that, besides the raw material, the cost of blending, tieing and weaving were found to be adding heavily to the production costs. The cost of the dyes was found to be very low due to the use of natural dyes.

4.3 SUBJECTIVE EVALUATION

Subjective evaluation of the four fabric samples was done to assess the visual and aesthetic characteristics by a panel of 50 members constituting of post graduate students and staff of Home Science College, ANGRAU, Hyderabad.

4.3.1 Awareness of blended fabrics of bast fibre origin

Above 50 per cent (60%) of the respondents were aware of blended fabrics of bast fibre origin (Fig.4.1 and Table 4.3). Since jute blends had occupied a place in the market, all the respondents were aware of these blends. This was followed by rest of the bast fibre blends such as mesta, ramie and pineapple leaf fibre blends.

Table 4.3: Awareness of blended fabrics of bast fibre origin

N=50

S.No.	Blend	No. of respondents
1.	Jute blends	30 (60)
2.	Mesta blends	13 (26)
3.	Ramie blends	10 (20)
4.	Pineapple blends	10 (20)

Figures in parenthesis indicate percentages

4.3.2 Awareness of articles made from banana fibre

Generally fibre handicrafts were made mostly from banana fibre owing to its lustre, white colour and easy dye uptake. Articles made from banana fibre were known to 42 per cent of the respondents. The reason for lack of awareness about these could be due to difficulty in identifying the fibre.

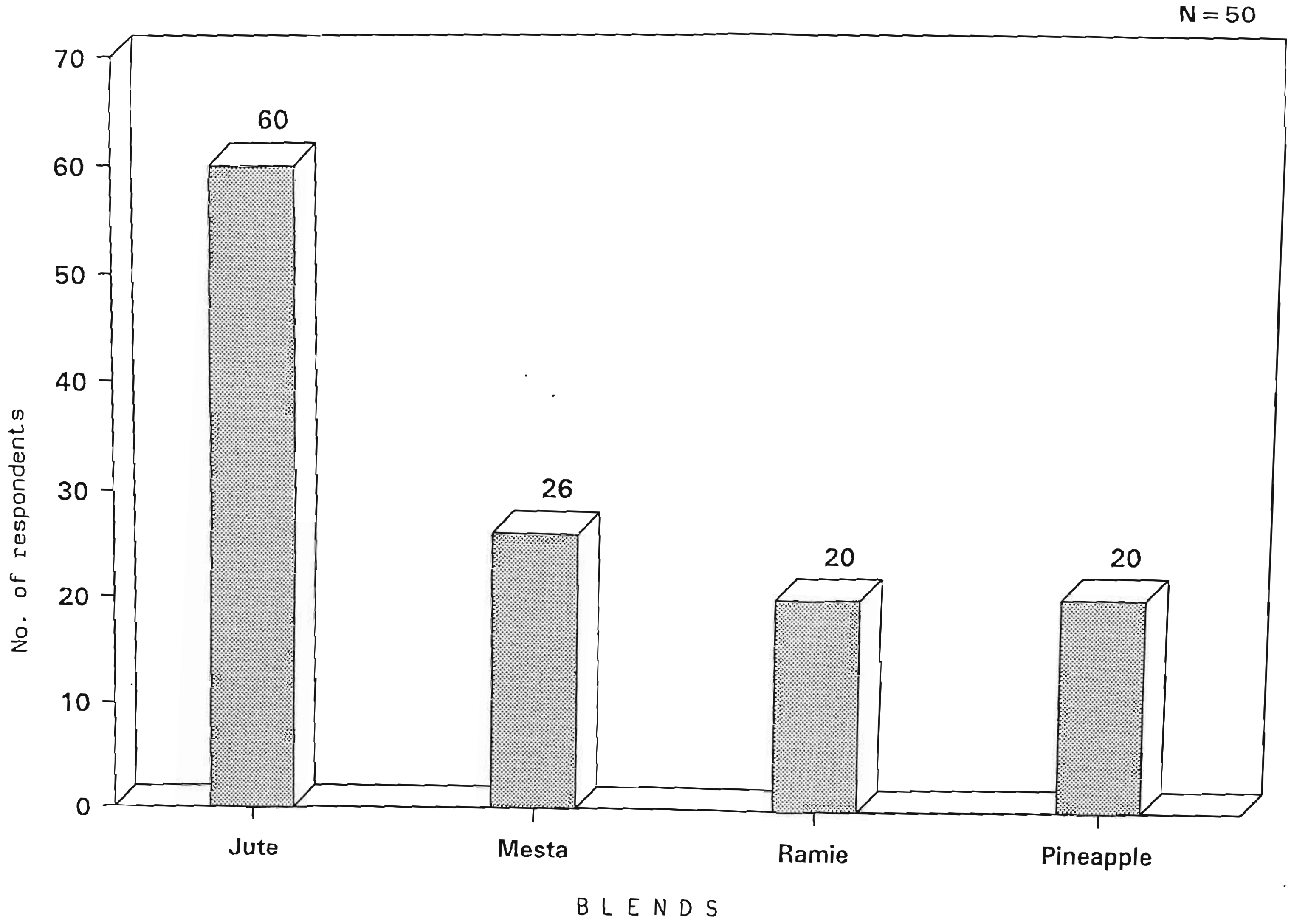

Fig 4.1 AWARENESS OF BAST FIBRE BLENDS

Table 4.4: Awareness of articles made from banana fibre

N=50

S.No.	Article	No.of respondents
1.	Wall hangings	15 (30)
2.	Table mats	14 (28)
3.	Door mats	12 (24)
4.	Letter holders	11 (22)
5.	Bags	10 (20)
6.	Coasters	7 (14)
7.	Durries	3 (6)
8.	Fabric	2 (4)
9.	Ropes	1 (2)
10.	Hats	1 (2)
11.	Garlands	1 (2)
12.	Purses	1 (2)

Figures in parenthesis indicate percentages

Table 4.4 clearly shows that wall hangings made from banana fibre were known to 30 per cent of the respondents followed by table mats (28%), door mats (24%) and letter holders (22%). Durries, fabric, hats, purses, ropes and garlands made out of banana fibre were known to very few respondents.

4.3.3 Awareness of tie and dye technique

Tie and dye (ikat) technique was known to 96 per cent of the respondents as shown in Table 4.5.

Table 4.5: Awareness of ikat dyed fabrics

N=50

S.No.	Fabric	No.of respondents
1.	Silk	35 (70)
2.	Cotton	48 (96)
3.	Wool	4 (8)
4.	Jute	15 (30)
5.	Blends of above	15 (30)

Figures in parenthesis indicate percentages

Majority of the respondents (96%) were aware of tie and dye technique on cotton followed by the technique on silk (70%) as cotton and silk ikats of Pochampally were popular in Hyderabad.

4.3.4 Suitability

The intended end use for the fabrics produced was furnishings. Hence the suitability of the samples for furnishings was subjected to panel evaluation, the results of which are given in Table 4.6.1 and Fig.4.2.

Table 4.6.1: Suitability of samples for furnishings

N=50

S.No.	Score	Suitability	Samples			
			A	B	C	D
1.	0	Unsiutable	1 (2)	1 (2)	-	-
2.	1	Fairly suitable	15 (30)	15 (30)	10 (20)	10 (20)
3.	2	Suitable	34 (68)	34 (68)	40 (80)	40 (80)

The samples 'C' and 'D' were ranked suitable by 80 per cent of the respondents. Sixty eight per cent of the respondents ranked the samples 'A' and 'B' as suitable. This might be due to the rough surface of 'A' and 'B' samples than 'C' and 'D' as expressed by the respondents, discussed later in this chapter. Twenty per cent and thirty per cent of the respondents ranked the samples 'C', 'D' and 'A', 'B' respectively as fairly suitable.

The respondents felt that the suitability of the samples was limited only to furnishing items such as door curtains, table covers, carpets and that they were unsuitable for bedsheets, pillow covers and diwan sets.

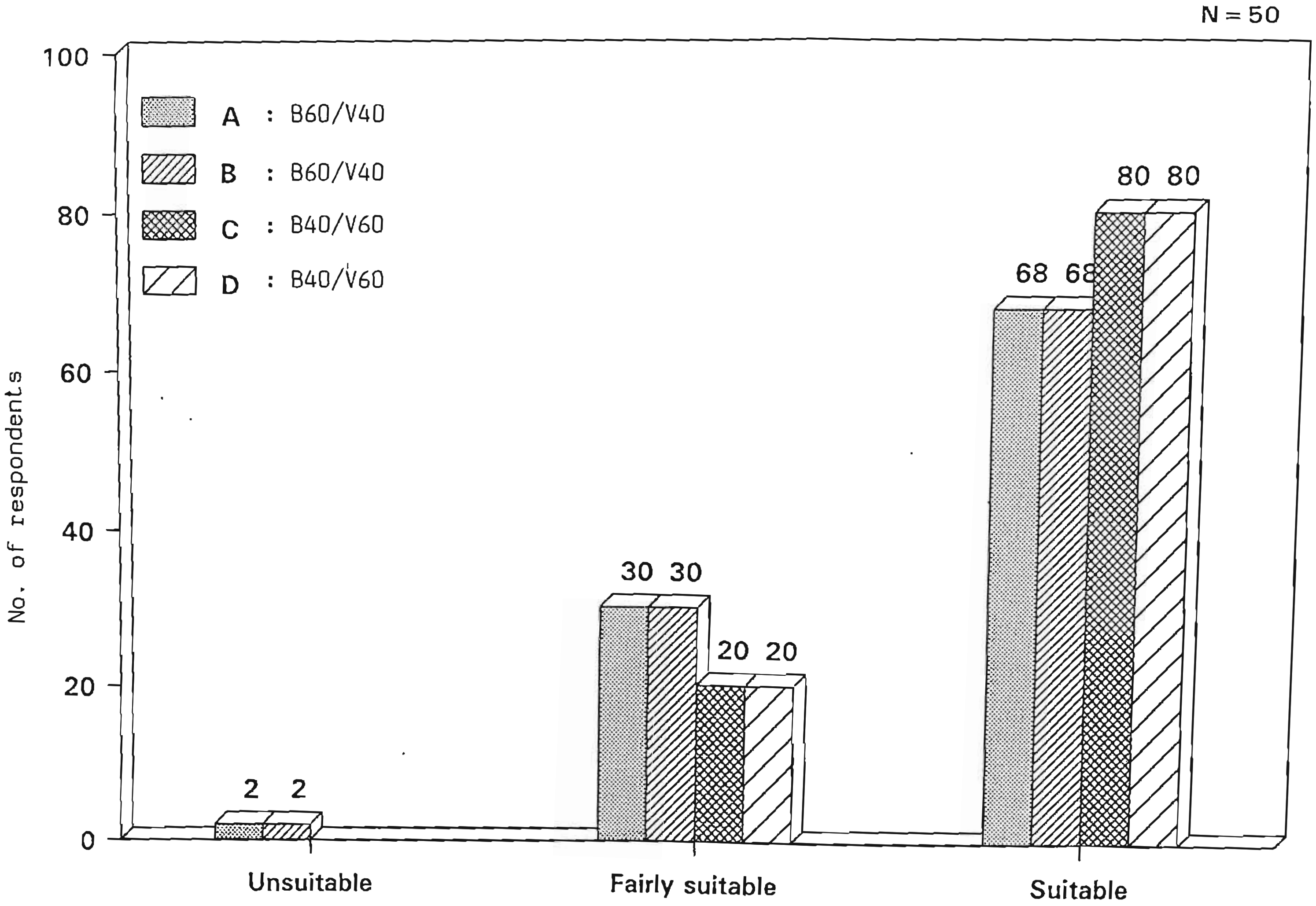

Fig.4.2: SUITABILITY OF SAMPLES FOR FURNISHINGS

Table 4.6.2 : Statistical analysis of suitability for furnishings between samples

Samples	Mean scores	F cal value	C.D. 5%	C.D. 1%
A	1.66			
B	1.66	1.5086[ns]	0.1824	0.2397
C	1.80			
D	1.80			

ns - not significant

The analysis of one way anova (Table 4.6.2) for the samples revealed that there was no significant difference between them.

4.3.5 Texture

Texture is the surface appearance and feel of the fabric. As seen from the Table 4.7.1 and Fig.4.3 the texture of the samples 'C' and 'D' was ranked slightly rough by 78 per cent of the respondents. As opined by 76 per cent of the respondents, samples 'A' and 'B' were rough. The samples 'C' and 'D' were ranked smooth and rough by 8 per cent and 14 per cent of the respondents respectively.

Table 4.7.1: Texture of the samples

N=50

Score/ S.No.	Texture	Samples			
		A	B	C	D
1.	Harsh	3 (6)	3 (6)	-	-
2.	Rough	38 (76)	38 (76)	7 (14)	7 (14)
3.	Slightly rough	9 (18)	9 (18)	39 (78)	39 (78)
4.	Smooth	-	-	4 (8)	4 (8)

Figures in parenthesis indicate percentages

Negligible per cent of the respondents ranked the samples 'A' and 'B' as harsh. Samples 'A' and 'B' had a higher degree of roughness than 'C' and 'D' probably because of the higher ratio of banana fibre in the former than the later. The protruding ends of the banana fibre seemed to have contributed to the rough texture of the fabric. The texture of the samples 'C' and 'D' was preferred first by all the respondents. Probably it indicates that banana fibre needs softening treatment before blending even though it changes the natural colour of banana.

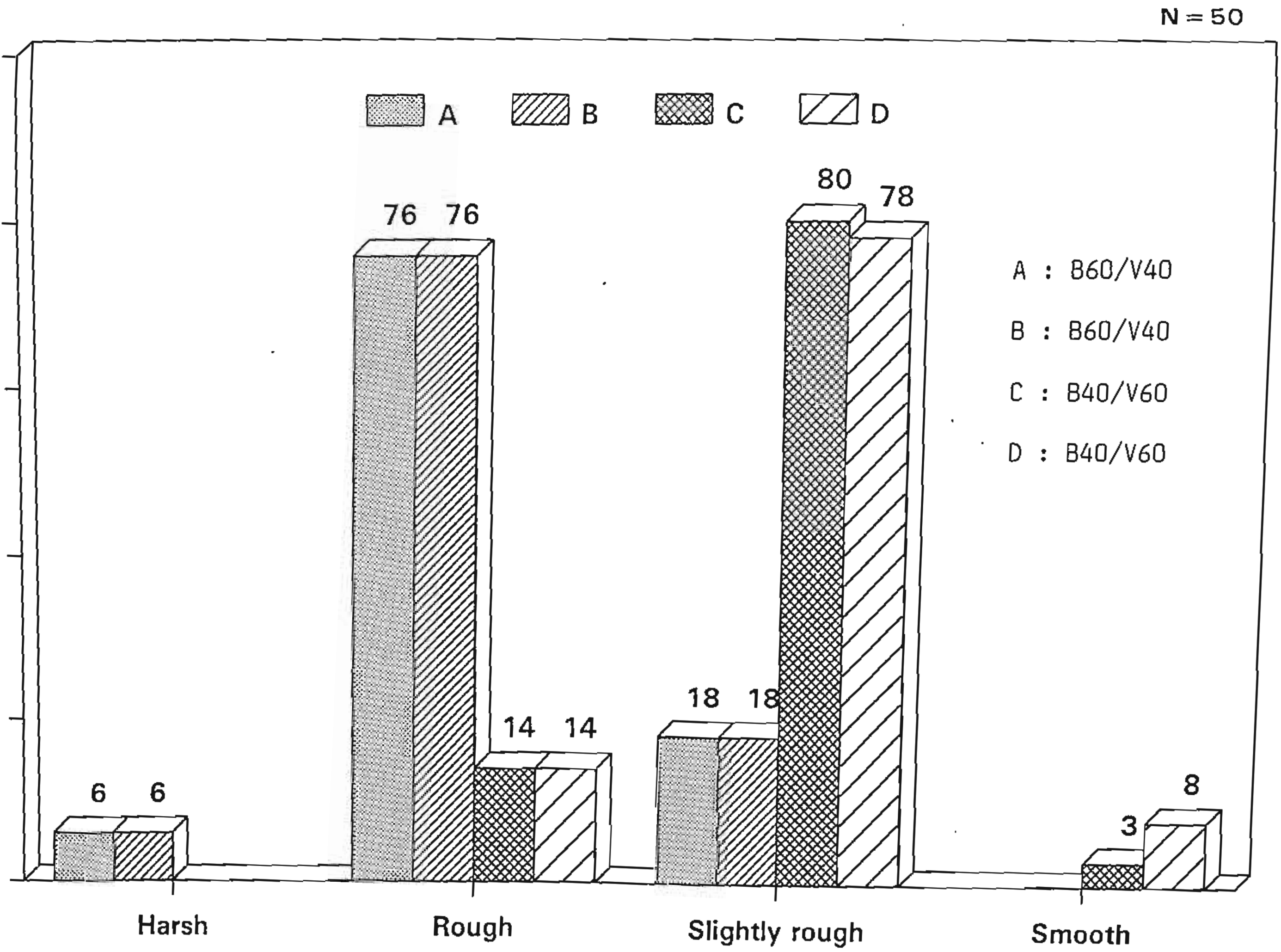

FIG 4.3: TEXTURE OF THE SAMPLES

Table 4.7.2: Statistical analysis of texture between samples

Samples	Mean scores	F cal value	C.D. 5%	C.D. 1%
A	2.12			
B	2.12	49.6946**	0.1862	0.2447
C	2.94			
D	2.94			

** - Significant at 1% level

The one way analysis also revealed that there was significant difference between the samples at one per cent level (Table 4.7.2).

4.3.6 Lustre

Lustre has a great influence on fabric aesthetics. It is associated with texture and colour of the fabric.

Table 4.8.1: Lustre of the samples

N=50

S.No./ Score	Lustre	Samples			
		A	B	C	D
1.	Dull	20 (40)	22 (44)	12 (24)	18 (36)
2.	Medium	29 (58)	28 (56)	31 (62)	29 (58)
3.	Bright	1 (2)	-	7 (14)	3 (6)

Figures in parenthesis indicate percentages

As evident from Table 4.8.1 and Fig.4.4, 56 to 62 per cent of the respondents ranked the four samples to have medium lustre. The lack of high degree of lustre in fabric samples could be due to projecting banana fibres. About 24 to 44 per cent of the respondents ranked the samples as dull. Negligible per cent of the respondents ranked the samples as bright. As evident from table 4.8.2, sample 'C' was found to be lustrous than the other three.

Table 4.8.2: Statistical analysis of lustre between samples

Samples	Mean scores	F cal value	C.D. 5%	C.D. 1%
A	1.62			
B	1.56	3.5233*	0.2189	0.2877
C	1.90			
D	1.70			

* - Significant at 5% level

This could be attributed to the bright indigo dye, brightness of the undyed portions of the fabric due to colour contrast and the higher proportion of viscose rayon in the sample. The difference in lustre between the samples was found to be significant at 5 per cent level.

4.3.7 Thickness

Thickness of the fabric decides its end use.

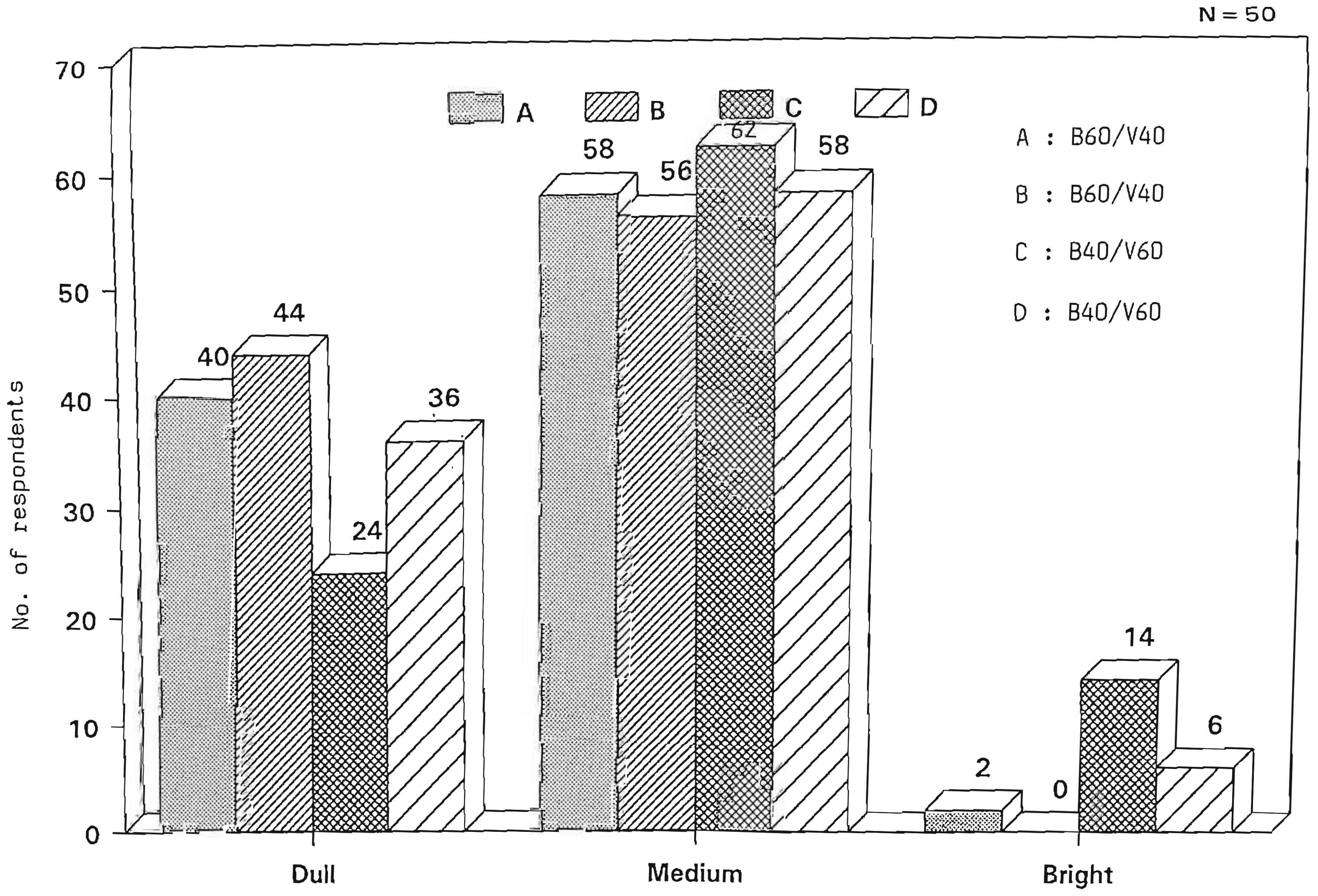

Fig.4.4: LUSTRE OF THE SAMPLES

Table 4.9: Thickness of the samples

N=50

S.No.	Thickness	No.of respondents
1.	Thin	-
2.	Medium	37 (74)
3.	Thick	11 (22)
4.	Very thick	2 (4)

Figures in parenthesis indicate percentages

Table 4.9 indicates the thickness of the fabric. It was opined by 74 per cent of the respondents that the samples were of medium thickness. Twenty two per cent of them felt that the samples were thick. Very few expressed that the samples were very thick. It is a known fact that furnishings are thicker hence the results.

4.3.8 Stiffness

Stiffness is the ability of the material to resist deformation and it greatly affects fabric drapability. Opinions of the respondents on the stiffness of the fabric samples are given in Table 4.10.1. Stiffness of the samples 'C' and 'D' was found to be medium as opined by 78 per cent and 74 per cent of the respondents respectively.

Table 4.10.1: Stiffness of the samples

N=50

Score	Stiffness	Samples			
		A	B	C	D
1	Low	-	-	2 (4)	2 (4)
2	Medium	27 (54)	28 (56)	39 (78)	37 (74)
3	High	21 (42)	22 (44)	9 (18)	10 (20)
4	Very high	2 (4)	-	-	1 (2)

The samples 'A' and 'B' also were ranked to have medium stiffness by 54 per cent and 56 per cent of the respondents respectively. Forty two and forty four per cent of the respondents ranked the samples 'A' and 'B' as highly stiff whereas, only eighteen and twenty per cent ranked the samples 'C' and 'D' as highly stiff.

Table 4.10.2: Statistical analysis of stiffness between samples

Samples	Mean scores	F cal value	C.D. 5%	C.D. 1%
A	2.50			
B	2.44	5.7865**	0.2035	0.2675
C	2.14			
D	2.20			

** - Significant at 1% level

The mean scores of the samples revealed that the samples 'A' and 'B' were stiffer than 'C' and 'D'. This might be because the former samples had a higher proportion of banana fibre than the later. The slight difference in the means of 'A' and 'B' might be because sample 'B' underwent tieing and dyeing twice. The one way analysis showed that there was significant difference among the samples at 1 per cent level (Table 4.10.2).

4.3.9 Drapability

Drapability is the ability of the fabric to assume graceful appearance in use. The aesthetics of any furnishings mainly depends upon its drapability and it is one of the deciding factors for its utility.

Table 4.11.1: Drapability of the sample

N=50

S.No./ Score	Drapability	Samples			
		A	B	C	D
1	Poor	2 (4)	2 (4)	1 (2)	1 (2)
2	Medium	24 (48)	24 (48)	18 (36)	18 (36)
3	Good	19 (38)	19 (38)	22 (44)	22 (44)
4	Very good	5 (10)	5 (10)	9 (18)	9 (18)

Figures in parenthesis indicate percentages

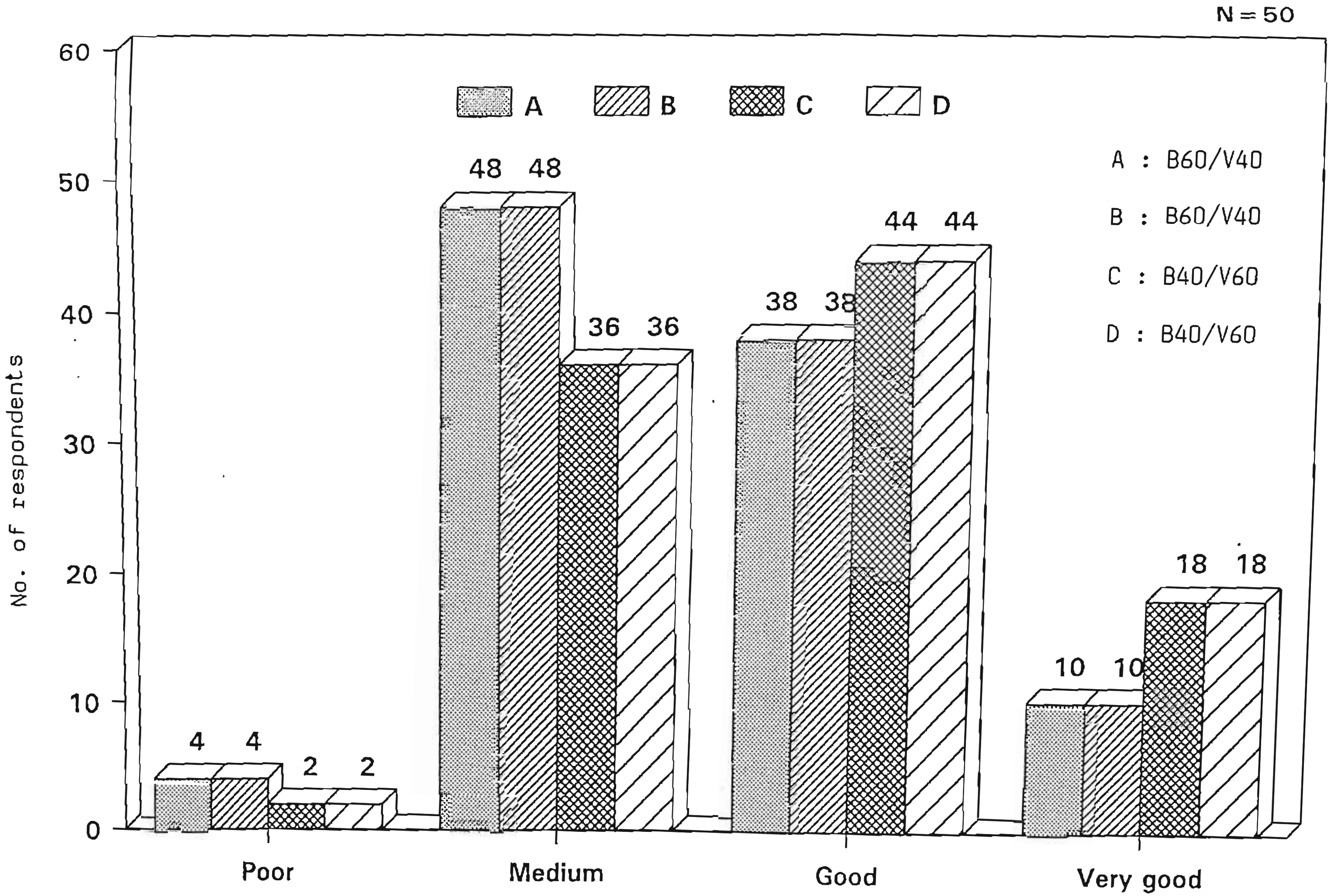

Fig.4.5: DRAPABILITY OF THE SAMPLES

It is obvious from the Table 4.11.1 and Fig.4.5 that the drapability of the samples 'A', 'B' and 'C', 'D' were ranked to be medium by 48 and 36 per cent of the respondents respectively. Thirty eight per cent and forty four per cent of the respondents ranked samples 'A', 'B' and 'C', 'D' respectively as good.

Table 4.11.2: Statistical analysis of drapability between samples

Samples	Mean scores	F cal value	C.D. 5%	C.D. 1%
A	2.54			
B	2.54	1.7105^{ns}	0.2937	0.3860
C	2.78			
D	2.78			

ns - not significant

The Table 4.11.2 shows the one way analysis of variance regarding drapability of samples. It revealed that there was no significant difference between the samples.

4.3.10 Colour

Colour has a prominent influence on the appearance of woven fabrics and hence influences consumer acceptance.

Table 4.12.1: Colour of the samples

N=50

S.No./ Score	Colour	Samples			
		A	B	C	D
1	Dull	8 (16)	20 (40)	6 (12)	13 (26)
2	Medium	34 (68)	24 (48)	30 (60)	27 (54)
3	Bright	7 (14)	6 (12)	13 (26)	10 (20)
4	Very bright	1 (2)	-	1 (2)	-

Figures in parenthesis indicate percentages

As seen from the Table 4J2.1 and Fig.4.6.1, above 40 per cent of the respondents expressed that the colour of the samples 'B' (48%) and 'D' (54%) was of medium brightness. The colour of the samples 'C' and 'A' was found to have medium brightness as viewed by 60 per cent and 68 per cent of the respondents respectively. Less number of respondents ranked the fabric samples 'A' and 'C' (mono colour) to be dull. Double coloured samples (B and D) were ranked as dull by noticeable per cent of the respondents and that could be due to their subdued shades.

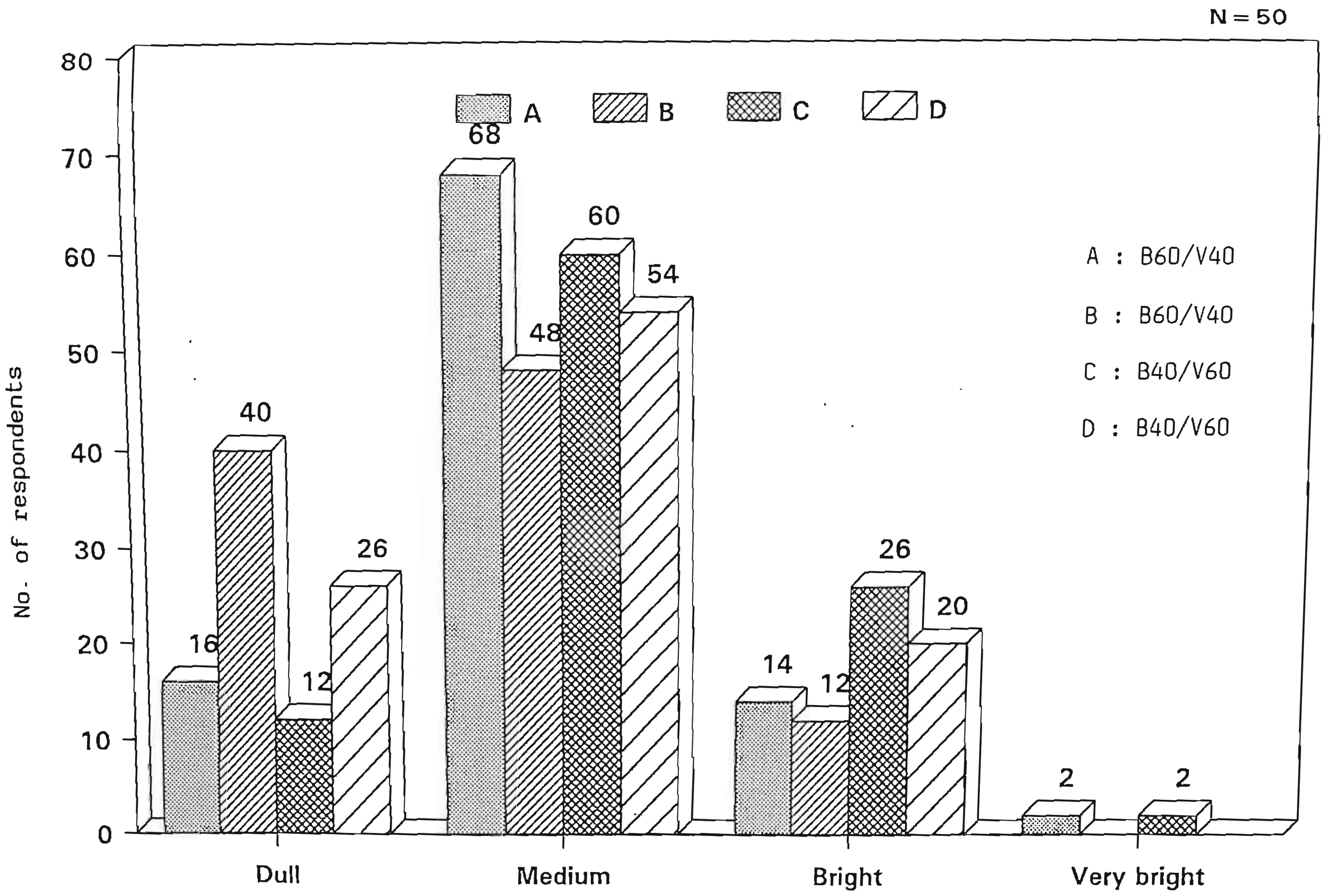

FIG.4.6.1: COLOUR OF THE SAMPLES

Table 4.12.2: Statistical analysis of colour between samples

Samples	Mean scores	F cal value	C.D. 5%	C.D. 1%
A	2.02			
B	1.72	4.2107**	0.2585	0.3398
C	2.18			
D	1.94			

** Significant at 1% level

Sample 'C' received the highest score for brightness as obvious from the table 4.12.2. When analysed, it was found that there was significant difference between the samples at 1 per cent level of significance.

Table 4.12.3: Preference of colour combinations

S.No./ Score	Preference	Samples	
		A and C	B and D
1.	Ist preference	40 (80)	10 (20)
2.	IInd preference	10 (20)	40 (80)

Figures in parenthesis indicate percentages

The preference of colour combinations is given in Table 4.12.3 and Fig.4.6.2. The combination of blue and natural off white colours (samples 'A' and 'C') was preferred by 80 per cent of the respondents as 'Ist preference' and 20 per cent of the respondents as 'IInd preference'. The combination of orange, yellow and offwhite (samples 'B' and 'D') was preferred by only 20 per cent of the respondents as 'Ist preference' but 80

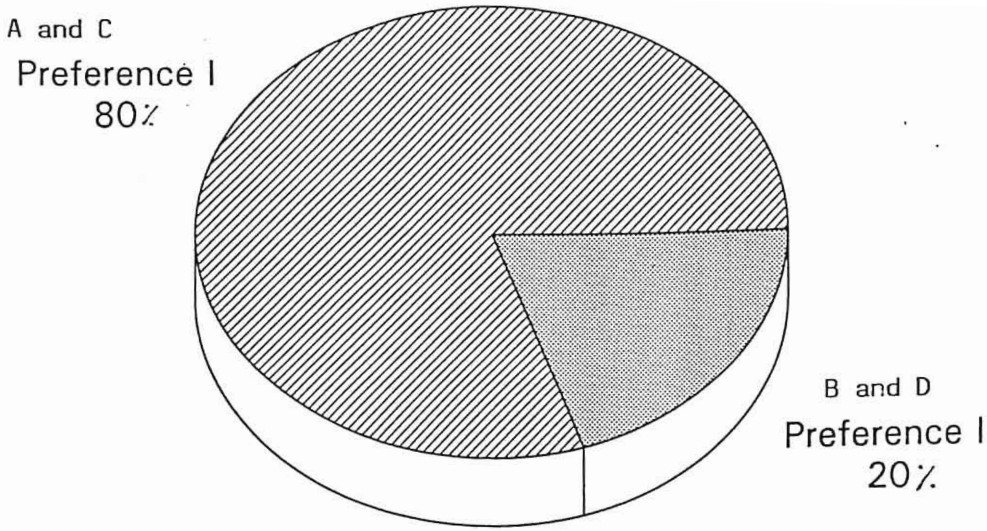

FIG 4.6.2: PREFERENCE OF COLOUR COMBINATIONS

per cent of the respondents opted as 'IInd preference'. The reason could be attributed to the brightness of the indigo dye used to dye 'A' and 'C' samples.

4.3.11 Designs

Table 4.13.1: Suitability of designs for furnishings

S.No./ Score	Suitability	Samples	
		A and C	B and D
1.	Fairly suitable	12 (24)	15 (30)
2.	Suitable	38 (76)	35 (70)

Figures in parenthesis indicate percentages

As seen from table 4.13.1, majority of the respondents had accepted the designs of 'A,C' and 'B, D' samples as suitable ikat designs for furnishings. Twenty four per cent (A, C) and thirty per cent (B, D) of the respondents expressed that the designs of the samples were fairly suitable for furnishings.

Table 4.13.2: Statistical analysis of suitability of designs between samples

Samples	Mean scores	F cal value	C.D. 5%	C.D. 1%
A and C	1.76	0.2997^{ns}	0.1754	0.2305
B and D	1.70			

ns - not significant

Table 4.13.2 shows that there was no significant difference between the samples with regard to suitability of designs.

Table 4.13.3: Size of the designs for furnishings

N=50

S.No.	Design	Samples	
		A and C	B and D
1.	Large	2 (4)	9 (18)
2.	Medium	45 (90)	40 (80)
3.	Small	3 (6)	1 (2)

Figures in parenthesis indicate percentages

The size of the ikat designs of 'A,C' and 'B,D' were ranked as 'medium' by 90 per cent and 80 per cent of the respondents respectively.

However, the preference with regard to design as expressed by majority of the respondents was the monocolour ikat design of samples 'A' and 'C' rather than the double colour design of 'B' and 'D' samples.

4.3.12 Preferential ranking based on overall appearance

Consumer preference is mostly based on the overall appearance of any fabric or product. The sample preferred most and next preferred was given a score of four, followed by three and those samples preferred third and fourth were scored as two and one respectively. Accordingly sample 'C' was ranked highest, followed by 'D' with scores of 176 and 133 respectively. Samples 'A' and 'B' were placed in positions third and fourth with scores of 105 and 85 respectively (Table 4.14.1 and Fig.4.7).

Table 4.14.1: Preferential ranking based on Overall Appearance

Samples	Order of Preference				Values as per weightage				Total	Rank
	1 (4)	2 (3)	3 (2)	4 (1)						
A	4 (4)	14 (3)	15 (2)	17 (1)	16	42	30	17	105	3
B	2 (4)	6 (3)	17 (2)	25 (1)	8	18	34	25	85	4
C	34 (4)	9 (3)	6 (2)	1 (1)	136	27	12	1	176	1
D	10 (4)	21 (3)	11 (2)	8 (1)	40	63	22	8	133	2

Values in parenthesis indicate score

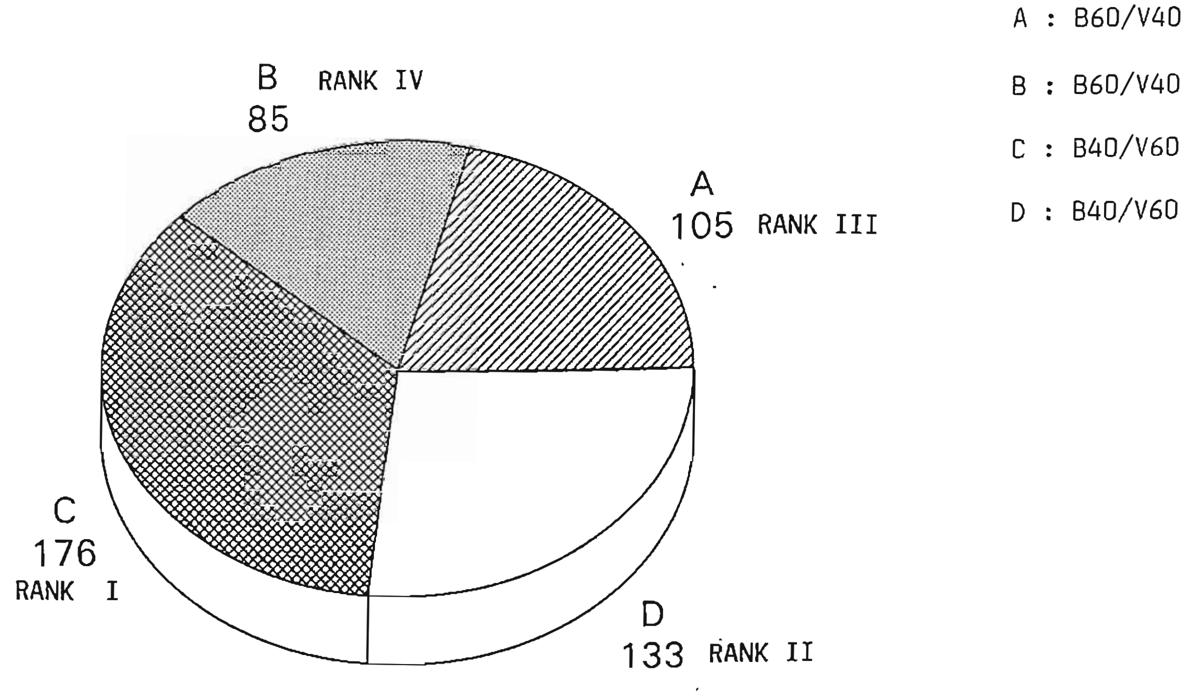

FIG 4.7: PREFERENTIAL RANKING BASED ON OVERALL APPEARANCE

Table 4.14.2: Statistical analysis for preferential ranking based on overall appearance

Samples	Mean scores	F cal value	C.D. 5%	C.D. 1%
A	2.08			
B	1.70	38.9401**	0.3518	0.4624
C	3.52			
D	2.66			

** - Significant at 1 per cent level

The mean scores from the analysis of variance had also supported the order of preference indicated above and showed that the F calculated value was significant at 1 per cent level (Table 4.14.2).

Sample 'C' was ranked 'first' because it had higher proportion of viscose that added to its better texture, lustre and drape. Colour and design were also some of the contributing factors which aided in its preference. On the other hand, though sample 'D' had same proportions as that of 'C', it was ranked only second, might be because of the subdued colour combination. Except for the above reason, the sample was equally good.

Inspite of being coarse and stiff, samples 'A' and 'B' also received good scores. When produced at commercial level, softening of banana fibres to reduce its stiffness and singeing to avoid protruding ends could be done to improve appearance and acceptability.

4.3.13 Cost of the samples

Cost has an important bearing on the consumer preferences besides the other factors.

Table 4.15: Cost of the samples

N=50

S.No.	Cost	No.of respondents
1.	High	3 (6)
2.	Reasonable	35 (70)
3.	Low	12 (24)

Figures in parenthesis indicate percentages

Majority (70%) of the consumers have considered the cost of the samples as reasonable. Few respondents have also felt that the cost of the samples was low (Table 4.15).

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Summary and Conclusions

CHAPTER V

SUMMARY AND CONCLUSIONS

Banana belongs to the family Musaceae and genus Musa. Beautiful fibre for various end uses could be extracted from the pseudostem of the plant, which is an agricultural waste after harvest.

The present study was undertaken to blend banana fibre with viscose rayon and to ikat dye the blend with the following objectives.

1. To blend banana fibre with viscose rayon in the ratio of 60 : 40 and 40 : 60.
2. To tie dye banana blended yarns.
3. To weave fabric using cotton as warp and banana viscose rayon blended yarn, dyed with ikat technique as weft.
4. To estimate the cost of finished products.
5. To study the consumer acceptance.

Banana fibre was manually extracted and blended with viscose rayon at carding stage and ring spun into a single yarn of 45 tex on cotton system. Blending was done in two proportions of 60 : 40 and 40 : 60. Two weft ikat designs were evolved to ikat-dye the blended yarns with natural dyes (Natural indigo, Myrobolan and Chawali-kodi) and was used for weft. $2/20^{s}$ cotton yarn was used for warp to provide strength and ease of weaving. Plain weave fabrics were woven on a frame loom and their cost per square metre was calculated. Laboratory tests were done to assess the colour fastness properties of the dyed smples. Subjective evaluation was carried out by a panel of 50 members constituting staff and post graduate students of college of Home Science. One way analysis of variance was employed to analyse the data.

The laboratory tests for colour fastness revealed that blue and orange colours had 'excellent' fastness whereas, yellow colour had 'fair' fastness to sunlight and washing. All the three colours had better rub fastness in dry condition than in wet condition.

The results of the subjective evaluation revealed that around fifty per cent of the respondents were aware of blended fabrics of bast fibre origin and articles made from banana fibre. Ikat technique was known to majority of the respondents.

It was reported by the respondents that the samples 'C' and 'D' (banana-viscose 40-60) better suited to the purpose than samples 'A' and 'B' (banana-viscose 60-40). This might be due to better lustre, texture and drape. The design and colour combination of (mono coloured samples) 'A' and 'C' were preferred than (double coloured samples) 'B' and 'D'. All the samples had a similar thickness and reasonable costs. Sample 'C' was given highest score based on overall appearance. As the woven fabrics are a bit coarse, they could be used for furnishing items such as curtains, floor coverings, sofa covers, diwan covers and table mats.

IMPLICATIONS OF THE STUDY

The study will be beneficial to textile and handloom sector. It will also be helpful to women enterpreneurs in cottage industries. Producing fabric out of banana fibre would not only be utilization but also, minimization of the agricultural waste. Since biodegradable fibres and natural dyes were used, it could be considered eco-friendly and its large scale production would help find a place in the international market and could a good source of foreign exchange. The waste after extraction of fibre would be a valuable raw material for paper industry.

SUGGESTIONS FOR FURTHER RESEARCH

1. Blending of banana fibre with viscose rayon could be tried out in various proportions as only two proportions were taken up for the present study.

2. Blending of banana fibre with other cellulosic fibres could be tried out.

3. New softening methods for banana fibre could be found out.

4. Blended yarn could be tried in both warp and weft directions, as it was tried only in weft direction.

5. Double ikat fabrics could be tried out of banana blends as only weft ikat was tried.

6. Different embellishments such as screen printing, kalamkari and batik could be tried out on banana blended fabrics.

7. Studies on other end uses such as apparel could be further studied on this fibre.

8. Studies can be taken up to make banana fibres as yarns by tieing long fibres together and weaving fabrics just as pineapple fibre, found in Phillipines.

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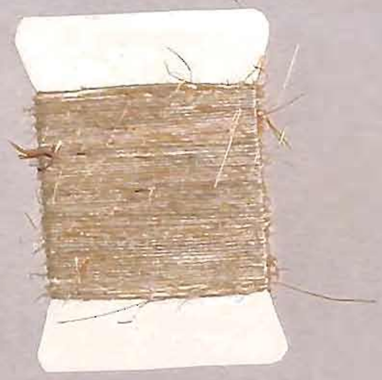
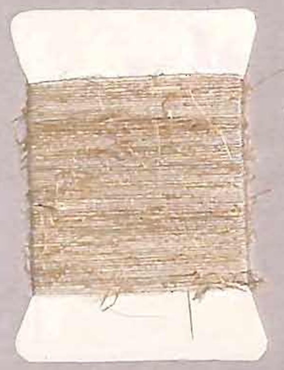
Appendices

APPENDIX - I

YARN SAMPLES

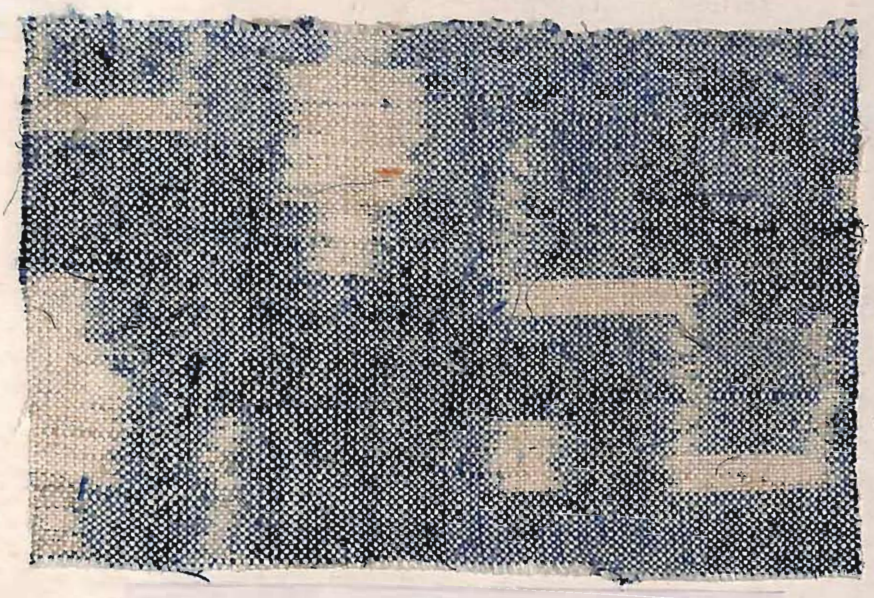


Banana : Viscose - 60 : 40



Banana : Viscose - 40 : 60

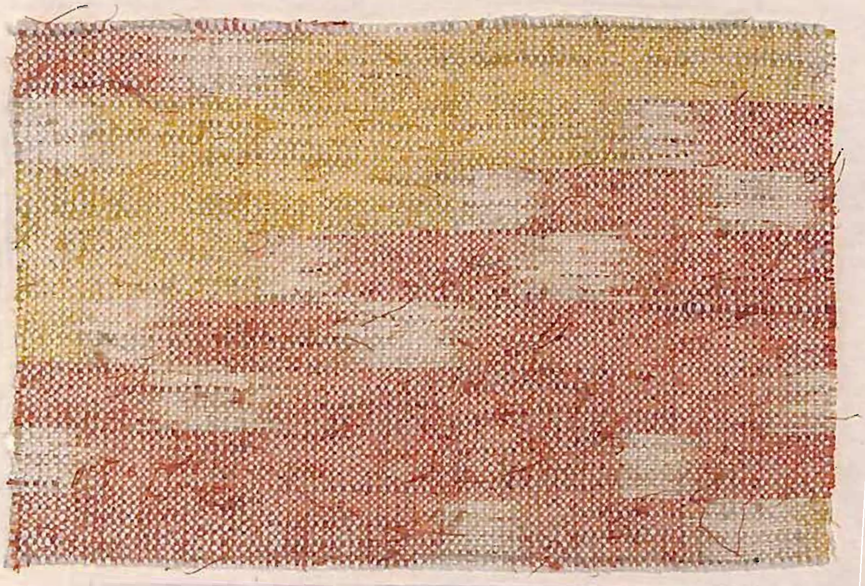
FABRIC SAMPLES



A

Warp - 100% Cotton

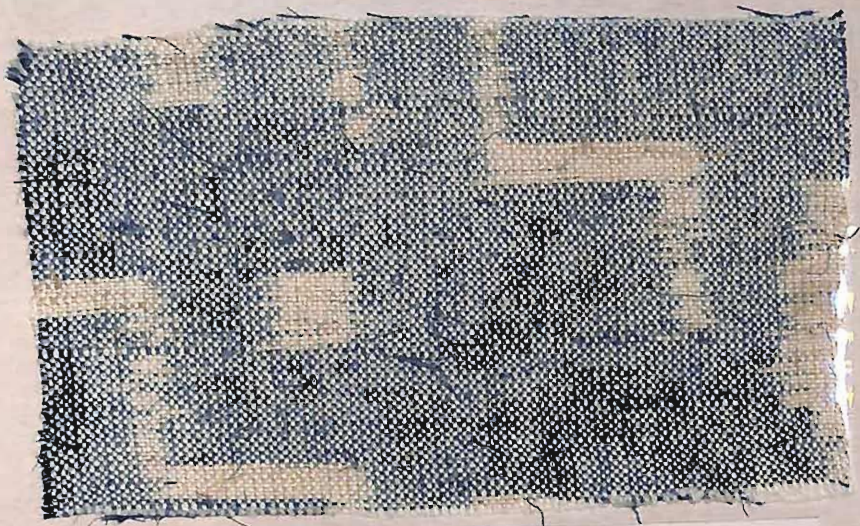
Weft - Banana : Viscose 60 : 40



B

Warp - 100% Cotton

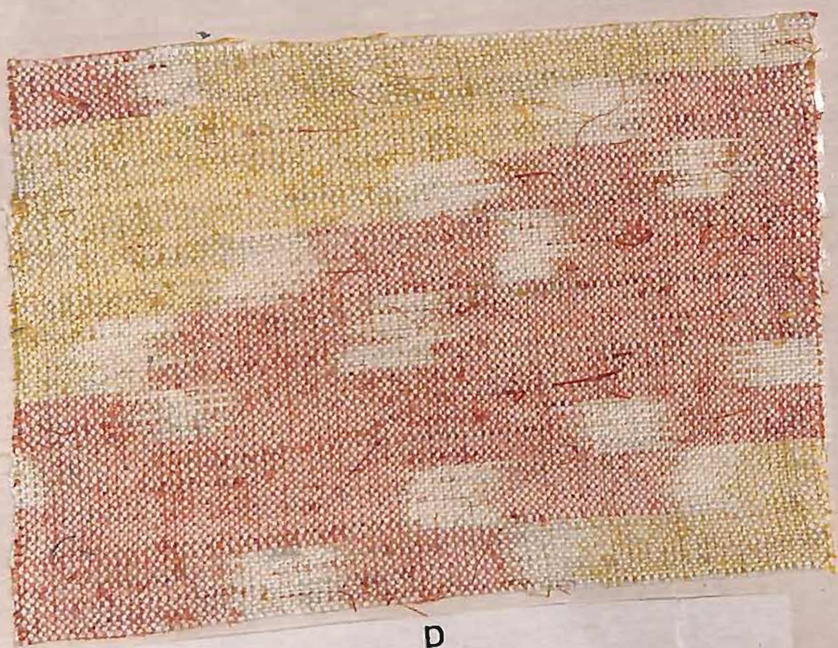
Weft - Banana : Viscose 60 : 40



C

Warp - 100% Cotton

Weft - Banana : Viscose 40 : 60



D

Warp - 100% Cotton

Weft - Banana : Viscose 40 : 60

APPENDIX - II

SCHEDULE TO ELICIT INFORMATION ON CONSUMER OPINION ON IKAT DYED BANANA BLENDED FABRIC

1. Name of the Respondent :
2. Age and Sex :
3. Qualification :
4. Are you aware of blended fabrics of bast fibre origin?

   Yes/No.

   If yes mention

   1. 4
   2. 5
   3. 6

5. Did you come across articles made from banana fibre?

   Yes/No

   If yes mention

   1. Coasters 2. Table Mats
   3. Door Mats 4. Wall hangings
   5. Letter Holders 6. Durries
   7. Bags 8. Any other

6. Are you aware of yarn tie and dye/Pochampally technique?

   Yes/No

   If yes on which fabric

   1. 4. 7.
   2. 5. 8.
   3. 6.

The presented samples are woven with 100 per cent cotton yarn as warp and banana-viscose rayon blended yarn as weft.

Code	Blend Proportion of weft yarn	Colour
A	Banana: Viscose 60% 40%	Mono colour
B	Banana: Viscose 60% 40%	Double colour
C	Banana: Viscose 40% 60%	Mono colour
D	Banana: Viscose 40% 60%	Double colour

Give your opinion for the following by (✓) where ever necessary for code details please refer the table

7. Indicate the suitability of the samples for furnishings

	A	B	C	D
1. Suitable				
2. Fairly suitable				
3. Unsusitable				

If unsuitable give reasons

1.

2.

3.

8. The texture of the fabric is

A B C D

1. Smooth
2. Slightly rough
3. Rough
4. Harsh

9. Rank the textures as per your perference

AB CD

10. The lustre of the fabric is

A B C D

1. Bright
2. Medium
3. Dull

11. The thickness of the fabric is

1. Very thick
2. Thick
3. Medium
4. Thin

12. The stiffness of the fabric is

A B C D

1. Very high
2. Good
3. Medium
4. Poor

13. The drapability of the fabric is

	A	B	C	D
1. Very bright				
2. Bright				
3. Medium				
4. Dull				

14. The colour of the fabric is

	A	B	C	D
1. Very bright				
2. Bright				
3. Medium				
4. Dull				

15. Rank the colour combinations as per your preference.

	AC	BD

16. Indicate the suitability of the designs for furnishings.

	AC	BD
1. Suitable		
2. Fairly Suitable		
3. Unsuitable		

17. The designs are

	AC	BD
1. Very bright		
2. Large		
3. Medium		
4. Small		

18. Rank the design as per your preference

AC BD

19. Give preferential ranking for the four samples

1.

2.

3.

4.

20. The cost of the sample is

	A	B	C	D
	Rs.41.30/ sq.mt.	46.10/ sq.mt.	41.70/ sq.mt.	46.30/ sq.mt.

1. Very high
2. High
3. Reasonable
4. Low

21. Please give suggestions and remarks if any,