A MANUAL OF INSTRUCTION IN VEGETAL DYE

A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF MASTER OF ARTS

IN THE GRADUATE SCHOOL OF THE

TEXAS WOMAN'S UNIVERSITY

COLLEGE OF HUMANITIES AND FINE ARTS

BY

PATRICIA BRAUGHT HULL

DENTON, TEXAS

MAY 1988

TEXAS WOMEN'S UNIVERSITY
DENTON, TEXAS

April 13, 1988
Date

To the Dean for Graduate Studies and Research:

I am submitting herewith a thesis written by Patricia Braught Hull entitled "A Manual of Instruction in Vegetal Dye". I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in fibers.

Linda Stuckenbruck
Linda Stuckenbruck, Major Professor

We have read this thesis
and recommend its acceptance:

Linda Stuckenbruck
John A. Calabrese
Susan Kaetz Grant

Accepted

Leslie M. Thompson
Dean for Graduate Studies and Research

ACKNOWLEDGMENTS

The author wishes to express gratitude to her graduate committee, Miss Susan kae Grant and Dr. John A. Calabrese. This study would not have been possible without the generous advice and guidance of Ms. Linda Stuckenbruck, chairperson.

ABSTRACT

A MANUAL OF INSTRUCTION IN VEGETAL DYE

PATRICIA BRAUGHT HULL

May 1988

This is an investigation of the colorfastness of dye techniques used in producing hues from vegetal material. The importance and desire for a wide range of color in artistic fiber art is emphasized. Artistic creations are of enduring value only if the colors survive over a period of time, thus the extreme importance of colorfast qualities.

In this study the yarns were mordanted, aged, and dyed. The samples were then mounted and tested. Results were evaluated and recorded.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

Statement Of The Problem

The proposed problem for study is the development of a publishable manual on the nature of vegetal dyes. Methods of vegetal dye have produced inconsistent results in the United States. The hues have been unstable and the chemicals used have often adversely affected the fiber. These problems can be solved by combining historical dye methods with a scientific approach.

Purpose Of The Study

The purpose of the proposed study is to develop a resource guide suitable for self instruction. The study is to develop a method of preserving the colorfast properties of vegetal dyes. This research is to be a manuscript for future publication.

Rationale

There is no available written thesis on ancient methods nor scientific data to make vegetal dyes lightfast. Present published vegetal dying methods do not result in permanent hues.

After many disappointing experimentations, an accident led to the discovery of a new procedure. Yarns had been prepared for dying in the usual way. An emergency prevented the wool from being used for some time. Later, when the yarns were dyed, it was found that the colors remained stable. Results of further experimentation will be presented in this study.

Background

The researcher was first introduced to vegetal dyes as a child. Picking berries left bright hues on hands and clothing. Appreciating color and desiring beautiful hues led the author to continue to experiment with flowers and berries.

While visiting France in 1957, the writer was able to study the tapestries and carpets of Versailles. The colors were clear and beautiful. After returning to the United States, the artist began to experiment with local plants. In 1968, spinning and weaving led to a need for a wider range of hues to create fiber art. The beauty of the colors obtained from vegetal dyes acted as an inspiration for this artist's weaving. However, a problem developed with the lightfastness of the yarns. Some faded almost immediately, while others lasted a few years. The lack of lightfastness of the hues proved discouraging. Since a search through existing written material helped little, the researcher began original experiments.

During this time the writer received a B.S. Ed. in Home Economics with graduate work in Art History, Museology, and Fiber Art. During the last ten years, investigative work has been done on approximately 350 samples from the western half of the United States. A special research program with Scottish author and teacher, Seonaid Robertson, was completed during this period. The writer has conducted numerous workshops and also has studied with Mary Francis Davidson (a recognized dye expert of this country).

Limitations

The writer does not intend to do an all-inclusive study of every area in vegetal dye. She will dye and test for lightfastness of wool yarns. The test will comprise a total of eighteen hues, with four samples of each color tested for periods of one, two, three and four years each.

CHAPTER II

REVIEW OF RELEVANT LITERATURE

In the words of a well known dyer, Elsie Davenport, "From time immortal, coloring matter has been transferred by one means or another from plants, animals or minerals to other substances such as pottery clay, fibers for plaiting and weaving, and to various parts of the human body - skin, hair and fingernails."[1] Man has not been content with natural colors and utilitarian simple weaves in fabrics. He wanted to duplicate the colors and patterns found in his environment for religious and aesthetic purposes.

"The history of dyeing, if it could be written, would be a record of constant striving after an ever-widening range of dye stuffs, capable of imputing all of the colors of the rainbow to any kind of material, and remaining unimpaired in all the conditions in which it would be used - an ideal yet to be achieved,"[2] states Davenport. Until recently the history of dye was only an oral history. Much valuable information was lost. Each new generation of dyers

---

[1] Elsie Davenport, Your Yarn Dyeing (Pacific Grove, Cal.: Craft and Hobby Book Service), 1972, p. 10.

[2] Ibid, p. 10.

had to rediscover the information. In France, in the 1600's, the dyeing of fibers was governed by the Crown.[3] Research and documentation occurred at this time. Equal importance was given to color and permanency of the dyes. Today many examples of tapestries and rugs may be seen in the museums and castles of France. The hues have mellowed with age but they still retain color.

When the researcher began her dye experience, her hues were not permanent. Available literature helped little. Having seen the rugs and tapestries in France and England, she knew there must be a way to retain the colors.

About the same time a Kenyan dyer, Lorna Hindmarsh, was doing research. In her book, A Notebook for Kenyan Dyers, she instructs the dyer to roll the wet mordanted wool in a wet towel and leave for three days.[4] The author remembered her "lost wet mordanted yarn" that had been stored in a cool dark place for a year. Is it possible that ageing wet mordanted wool helps it retain the colors? This research is a result of that question.

Another recent research of permanency of vegetal dyes was done by Patricia Crews, an instructor at Kansas State

---

3 KG Ponting, Dictionary of Dyes and Dyeing (London: Bell and Hayman Limited), 1980, p. 52.

4 Lorna Hinmarah, A Notebook for Kenyan Dyers (Nairobi: National Museum of Kenya), p. 82.

University, Manhattan, Kansas. She was awarded a KSU Faculty Research Grant in the summer of 1979 to conduct research on the lightfastness of natural dyes. The results of her literature review and research was presented in a two part series of articles. The first article discussed mordant selection and the second article dye-plant selection in relationship to lightfastness. The study of the methodology was informative. Since the mordant used was different than the one used in this study, the report was not appropriate to this research.

CHAPTER III

METHODS AND PROCEDURES

Phase I: Examination of Relevant Literature

For this thesis, the writer did an extensive study of available vegetal dye publications. The following were found to be relevant; Dyes from Plants, A Handbook of Dyes from Natural Materials; A Dictionary of Dyes and Dyeing; A Notebook for Kenyan Dyers; Traditional Scottish Dyes; A Weaver's Garden; The Color Cauldron; Color for the Hand Papermaker; and The Complete Illustrated Book of Dyes from Natural Sources. Other sources were Patricia Crews', "Considerations in the Selection and Application of Natural Dyes: Mordant Selection," Spring, 1981 issue of Shuttle, Spindle and Dyepot; and "Mordanting", Winter, 1976 issue of Journal of the Chicago Horticultural Society.

Visits to museums and galleries, as well as attending regional and national conferences and workshops, served as secondary sources of information.

The researcher found visits with other dyers, such as Anne Bliss, Sheonaid Robertson, Su Grierson, and Michelle Whipplinger, very helpful.

Phase II: Studio work,
Experimentation, and Testing

The fiber utilized for this study was natural white French Merino wool. To maintain uniformity, all samples were from a single batch purchase, produced by one supplier. It arrived in single pound hanks. These were divided into skeins, 9 yards in length. The yarn was tied in three places to prevent tangling.

Since chlorine has a negative effect upon the chemistry of vegetal dyes, only chlorine free, soft water was used in all washing and processing procedures. The wool was washed with Orvis (a neutral ph soap). The yarns were washed three times, each washing procedure consisted of soaking one hour, followed by a double rinse. The yarn was soaked overnight in a vinegar bath before the final rinse. The vinegar bath was prepared by adding 2 tablespoons of vinegar per gallon of water.

The next step was to chemically prepare the yarn to accept the vegetal dyes by a process known as mordanting. Since some of the chemicals used for mordanting are toxic, as a precautionary habit, all mordanting procedures should be performed outside. Other safety measures include the use of rubber gloves, protection for eyes, and avoidance of breathing fumes from toxic chemicals.

The samples used in this study were mordanted with potassium aluminum sulfate, KAI $(SO_4)_2O$ $12H_2O$, commonly called alum. Potassium bitartrate, $KHC_4H_4O_6$, commonly known as cream of tartar was also used. For each 120 grams of dry fiber, use 30 grams of potasium aluminum sulfate and 7 grams of postassium bitartrate. The chemicals were mixed in a non-reactive aluminum pot with 8 ounces of water. The mixture was heated to 180°F. and thoroughly stirred. See appendix A.

This solution was poured into an 11.5 quart enamel pot containing two gallons of water and thoroughly stirred. Then the wet yarn was added. Quantity of yarn should be limited to the point that it may move freely in the solution to enable the chemical to react with all of the fibers. A thermometer was attached to the side of the pot and the solution was slowly heated to 180°F., where it was maintained for one hour. The pot was removed from the heat and the solution was cooled to 100°F. See appendix A.

The yarn was removed and squeezed to remove excess solution before being hung to drip. When dripping stopped, the fibers were placed in a clean white bag and placed in the refrigerator to age for three weeks. Care was taken to make sure the yarn did not dry out during this time. It was examined bi-weekly and dampened with water as needed.

The next step in the process was to dye the aged, mordanted yarn. In order to have pure dyes for this study, the vegetal dyes were purchased in the form of crystals or extracts. The strength of the dye was listed on the label.

Although the amount of dye material varied from hue to hue, the steps for dying each color were the same. The same safety procedures used in mordanting were followed in dying the fibers. The yarns were soaked in water one hour while the dye bath was being prepared.

The predetermined quantity of dye was added to 8 ounces of water in an enamel pan, where it was stirred while heating to 180^{o}F. Care should be taken that the dye is thoroughly dissolved. This solution was poured into an 11.5 quart enamel pot containing two gallons of water. This dye solution was stirred thoroughly and the wet, mordanted, aged yarn was entered. Yarn should move freely in the solution to enable the dye to react with all of the fibers. A thermometer was again attached to the side of the pot and the solution was slowly heated to 180^{o}F, where it was maintained for one hour. The pot was removed from the heat and the solution was allowed to cool to 100^{o}F. All samples were dyed by this technique, except that the process was repeated with a second dye source on the nine overdye samples. See appendix B.

The dyed yarns were labeled with a waterproof marker and hung in the shade to dry. The information included the name of the dye or dyes, form of dye (crystal or extract), strength of the dye, mordant, fiber, and date.

After drying the skeins were washed with Orvis soap and hung in the shade to dry. A double thick, lead laminated pouch was used to store the dyed samples until they were prepared for testing. See appendix C.

A controlled light source which would duplicate natural sunlight as much as possible was needed for testing the lightfastness of the samples. A plywood enclosure 60 inches tall, 48 inches wide and 36 inches from front to back was built. The 48 inch florescent fixture was mounted vertically on the inside of the back panel. This centered position provided a consistant light source, a minimum of 33 inches and a maximum of 37 inches from any of the samples mounted on the inside of the front panel. To allow excess heat to escape and faciitate periodic removal of samples from the box, the sides were left open. See appendix D.

Two 40 watt black light florescent (Sylvania F40 BL) bulbs were used as a light source. Black florescent lighting was chosen because of the full spectrum of light rays emitted. Eighty minutes exposure to this intense light source was calculated to equal 8 hours of daylight.

In preparation for the testing process, each 9 yard sample was divided into 5 skeins, 63 inches in length. A letter was assigned to each of the eighteen hues and a number (1 through 5) was assigned to each of the five test skeins of each hue. See appendix E.

A control sample was tagged and placed in a labeled envelope. The following information was on each label: name of dye or dyes, form of dye, strength of the dye, mordant, fiber, date, letter, and number. The envelopes containing the control samples were placed in a double thick, lead laminated pouch. The remaining four skeins were stitched to a cardboard and labeled. A blue wool fade card was also stitched to the cardboard adjacent to each sample. The board with the samples and blue wool fade cards were mounted on the front panel of the test enclosure.

For this test, the first test skeins were removed after 487 hours test exposure, calculated to equal 365 eight hour days of daylight exposure. The second test skeins were left exposed 974 hours (to equal two years daylight exposure). The third test skeins were left exposed 1,461 hours (equal to three years daylight exposure). The last test skeins were removed after 1948 hours exposure to the test light (to equal four years daylight exposure). As the samples were removed from the test panel, each was placed in an envelope labeled with a letter and the appropriate sample number. The labeled envelopes were then returned to the lead lined storage pouch to await the completion of the test on all samples.

Phase III: Preparation of this Thesis

During phase III, the researcher evaluated and compiled the findings of this study. All of the findings, photographs and samples were arranged in a final manuscript.

CHAPTER IV

FINDINGS

The emphasis of this research was to test aged mordanted vegetal dyed wool yarns for lightfastness. The investigator began the study by alum mordanting, ageing, vegetal dyeing, washing and color testing the wool yarns. Using the traditional mordanting and dyeing methods produced poor lightfast qualities. The author had seen vegetal dye fabrics in museums. These fibers showed little fading. After researching printed material and talking with other dyers, the researcher decided to investigate the effects of the ageing process on lightfastness.

The study had two limitations. One problem was that only a few samples were tested. The second limitation was the length of testing time. Only a time span equal to four years was used. Longer testing could reveal a more accurate result.

The study required simple inexpensive equipment. Dye goods were cheap and easy to obtain. As the author researched this study, she discovered that more questions presented themselves. This research became only a pilot test as more investigation is needed.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to develop a method of preserving the colorfast properties of vegetal dyes on wool yarns. The researcher dyed three hundred yarns. From that group, she selected eighteen hues with five samples each to test for colorfastness.

Each hue was tested for periods that equaled one, two, three and four years. Four hundred eighty hours of continuous exposure to intensive ultraviolet light was calculated to equal one year natural light exposure. A Blue Wool Fading Card was included with each group of samples. The control sample was stored in a lightproof lead lined bag. Each sample was placed in a labeled envelope for positive identification.

The dye samples were tested with the Blue Wool Fading Cards. Dyes included in this test were synthetic indigo, indigo and fustic crystals; logwood sawdust; cochineal and logwood; madder and butternut; brazilwood, osage orange and cochineal; brazilwood crystals; madder powder; madder, cutch and cochineal; logwood crystals; fustic, logwood and cochineal; ground cochineal; ground cochineal and logwood;

madder crystals and logwood; ground madder; brazil crystals with alum and club moss. Alum was the only mordant used. The tests were performed on wool yarn.

The most fugitive hues were yarns dyed with logwood crystals and logwood sawdust, brazilwood with club moss, ground madder and club moss, and fustic. Fustic and logwood faded at standard I of the Blue Wool Fade Cards. Ground madder and club moss showed a gradual change, as did fustic and madder. Yarns dyed with cochineal and logwood crystals faded rapidly. The logwood hue faded at standard III. When the crystal form of logwood was used, less fading occurred than when the sawdust form was chosen.

The most stable of the dyes used were indigo, cochineal, osage orange, brazilwood crystals, and ground madder. Overdyes of madder, cutch, and cochineal as well as madder, butternut, and brazilwood showed only a small amount of gradual fading.

When evaluating this research the author made several observations. Yarns dyed with the crystal form of woods showed less brown than the sawdusts. The crystals resulted in clearer, more stable hues except the fustic, logwood and cochineal overdye. When brazilwood and club moss were used together, the result was a grey, weak hue. Brazilwood produced a bright, clear, intense color when used alone.

The author concluded that a limited number of lightfast hues can be produced by the ageing method of dye. The resulting hues could be used successfully for clothing, but not for upholstery or wall hangings.

This research project raised more questions than were answered. Would the hues be more colorfast if the ageing process were used with other mordants? For example, alum plus another mordant could have been used. What effect do the the various minerals contained in water have on the lightfastness and color of the dyes? This researcher used purified water for one group of tests, resulting in poor colors. The investigator would like to continue study of the effect of water on the dyes and colorfastness.

This author found that the weather conditions greatly effected the hues. Dry years produced dusty pale hues. Wet years produced muddy greyed colors. Late or early frosts effected the length of the dye season. It also effected the number of dyes available. Optimum dye years happen rarely. This limits vegetal dyes for the professional artist. One solution is to purchase vegetal dyes from commercial suppliers.

The study is to become the basis of a manual of instruction in vegetal dye. There are a number of books on basics but not on specific problems. This book is to explore one of the major problems, lightfastness. If dyes are not permanent, the work loses it's aesthetic value. Home and professional dyers alike need a dependable dye method.

As a result of this study, this author has concluded that both chemical and vegetal dyes have strong and weak points. Color, for the sake of color, is more important than whether chemical or vegetal dyes are used.

DEFINITION OF TERMS

Adjective: "Natural dyes that need a mordant to fix the dye permanently in the fiber." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 86.

Alum: "A white powdery substance used as a mordant in dyeing; usually aluminum potassium sulfate ($KAI(SO_4)_2O$ $12H_2O$)." Buchanan, Rita, A Weaver's Garden, Loveland, Colo., Interweave Press Inc., 1987, p. 217.

Blooming: "A process which brightens colors by the use of stannous chloride. It is usually done at the midpoint of dyeing and is followed by a soap bath." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 86.

Chrome: "Bichromate of potash, potassium dichromate, potassium bichromate." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 86.

Copper sulphate: "Bluestone, blue vitriol." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 86.

Cream of tartar: "Agrol, tartaric acid." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 86.

Dye-bath: "The dye liquor diluted with water to equal four gallons of liquid." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 87.

Dye-source: "Plant or animal source capable of producing a natural dye." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 87.

Iron: "Copperas, green vitriol, ferrous sulphate." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 88.

Mordant: "A chemical compound, usually metallic salts, that is applied to fiber to increase the intensity and fastness of dyes." Buchanan, Rita, A Weaver's Garden, Loveland, Colo., Interweave Press Inc., 1987, p. 217.

Natural or Vegetal Dyes: "Dyes from natural sources (animal, vegetable, or mineral) as opposed to synthetic dyes. Brown, Rachel, The Weaving, Spinning, and Dyeing Book, New York, Alfred A. Knopf, 1978, p. 351.

Preferential Fading: "This is due to the fact that the yellows, fawns or browns which originally combined with the blue to make various shades of green, have faded out first leaving only the blue behind. A term known as preferential fading." Grierson, Su, The Color Cauldron, Angus, Scotland, Oliver McPherson, Ltd., 1986, p. 53.

Saddening: "A process which darkens colors by the use of ferrous sulphate, usually applied at the midpoint of dyeing; also called stuffing." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 88.

Scouring: "Thoroughly cleaning raw wool to remove the dirt and grease." Buchanan, Rita, A Weaver's Garden, Loveland, Colo., Interweave Press Inc., 1987, p. 211

Simmer: "A pre-boil state ranging from 170° to 190°F. (77° to 88°C.).", Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 88.

Skein: "A hank of yarn: yarn arranged in an oval so that it may be mordanted and dyed." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 88.

Skirt: "Remove the short, dirty fibers from the edges of a fleece." Brown, Rachel, The Weaving, Spinning, and Dyeing Book, New York, Alfred A. Knopf, 1978, p. 351.

Substantive: "Natural dyes which color yarns permanently without need of mordants." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 89.

Tie-dye: "Tightly binding sections of a skein of yarn so they cannot absorb the dye; produces a variegated effect." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 89.

Tie-off: "The securing of the skein of yarn with some non-shrinking white cord. Usually the wool is tied off in four places. The tie-off should be tight enough to prevent the wool from tangling, but free enough to let the mordant and dye penetrate." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 89.

Tin: "Stanous chloride." Schultz, Kathleen, Create Your Own Natural Dyes, New York, Sterling Publishing Co., Inc., 1975, p. 89.

Top-dyeing: "The process of dyeing yarn or fabric sequentially in two or more different dye baths in order to combine colors. Buchanan, Rita, A Weaver's Garden, Loveland, Colo., Interweave Press Inc., 1987, p. 220.

SELECTED BIBLIOGRAPHY

Adrosko, Rita. Natural Dyes and Home Dyeing. New York: Doner Publications, Inc., 1971.

Brown, Rachel. The Weaving, Spinning, and Dyeing Book. New York: Alfred A. Knopf, 1978.

Buchanan, Rita. A Weaver's Garden. Loveland, Colo.: Interweave Press, 1987.

Crews, Patricia. "Considerations in the Selection and application of Natural Dyes: Mordant Selection." Shuttle, Spindle, & Dyepot, Spring 1981, pp. 15,62.

Davenport, Elsie. Your Yarn Dyeing. Pacific Grove, Cal.: Craft and Hobby Book Service, 1972.

Davidson, Mary Francis. The Dyepot. Gatlinberg, Tenn.: Published by Author, 1974.

Fraser, Jean. Traditional Scottish Dyes and How to Make Them. Edinburgh: Canongate Publishing Ltd., 1983.

Gerber, Frederick H. Cochineal and the Insect Dyes. Ormond Beach, Fla.: Published by Author, 1978.

Grae, Ida. Nature's Colors. New York: MacMillan Publishing Co., 1974.

Grierson, Su. The Colour Cauldron. Angus, Scotland: Oliver McPherson Ltd., 1986.

Hindmarsh, Lorna. A Notebook for Kenyan Dyers. Nairobi, Kenya: National Museum of Kenya, 1982.

Koretsky, Elaine. Color for the Hand Papermaker. Brookline, Mass.: Carriage House Press, 1983.

Krochmal, Connie. Complete Illustrated Book of Dyes from Natural Sources. Garden City, New York: Doubleday and Co., 1974.

Lesch, Alma. Vegetable Dyeing. New York: Watson-Gupstill Publications, 1970.

Pesch, Barbara. "Preparation of Dyebath." Journal of Chicago Horticulture Society vol. iii, no. i (Winter 1976): 28-29.

Ponting, K. C., A Dictionary of Dyes and Dyeing. London: Bell and Hyman, Ltd., 1980.

Robertson, Seonaid. Dyes from Plants, A Handbook of Dyes from Natural Materials. New York: Van Nostrand Reinhold Co., 1973.

Schultz, Kathlen. Create Your Own Natural Dyes. New York: Sterling Publishing Co., Inc., 1975.

Stevens, Williams Chase. Kansas Wildflowers. Lawrence, Kan.: Kansas University Press, 1948.

APPENDICES

APPENDIX A

Mordanting Yarn

Equipment used to mordant yarn

Mordants, mixed with a cup of water,
are added to the mordant pot.

Mordanting the yarn

APPENDIX B

Dyeing Yarn

The dye is mixed with a small amount of water. This solution is poured into a pot of water.

Wet mordanted and labeled yarn
is placed into the dye solution.

After simmering for one hour,
the dyed yarn is checked
for intensity of hue.

APPENDIX C

Storing Yarn

Dyed yarns were stored in
a lead lined bag until
they were tested.

APPENDIX D

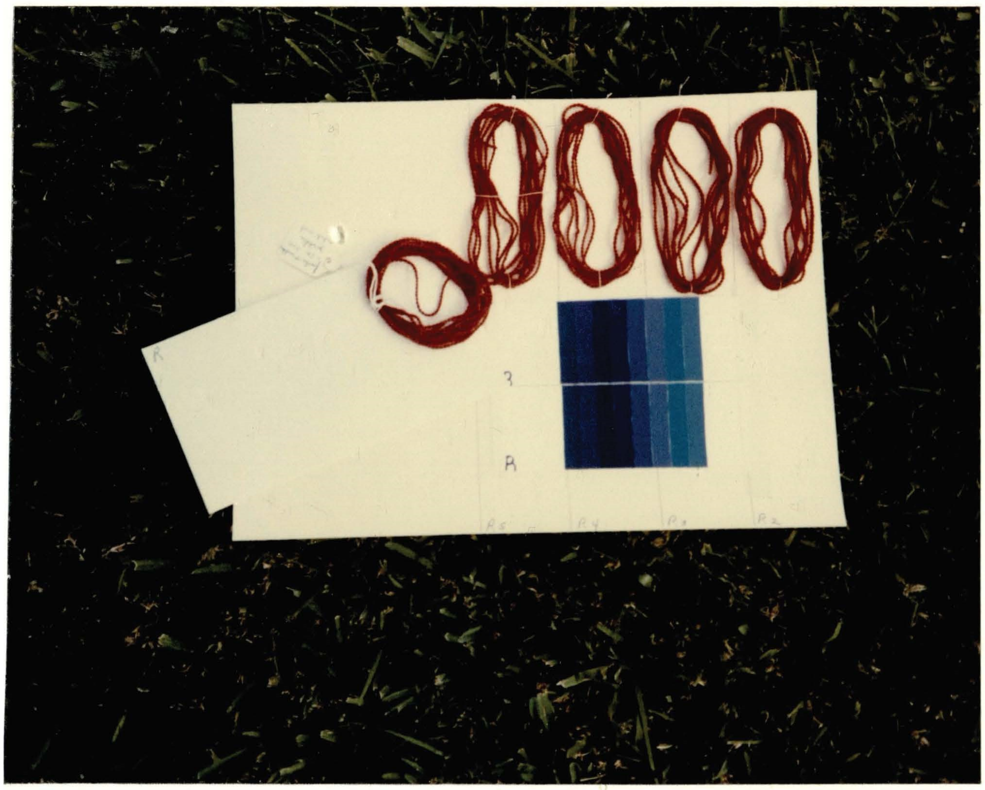
Testing Box

Lightfast testing box showing
ultraviolet flourescent lamps.

APPENDIX E

Testing Yarn

Mounted samples and Blue Wool Fade
Cards prepared for testing



The control sample is placed in
labeled envelope for storage
in lead lined bag.

Samples mounted in test box

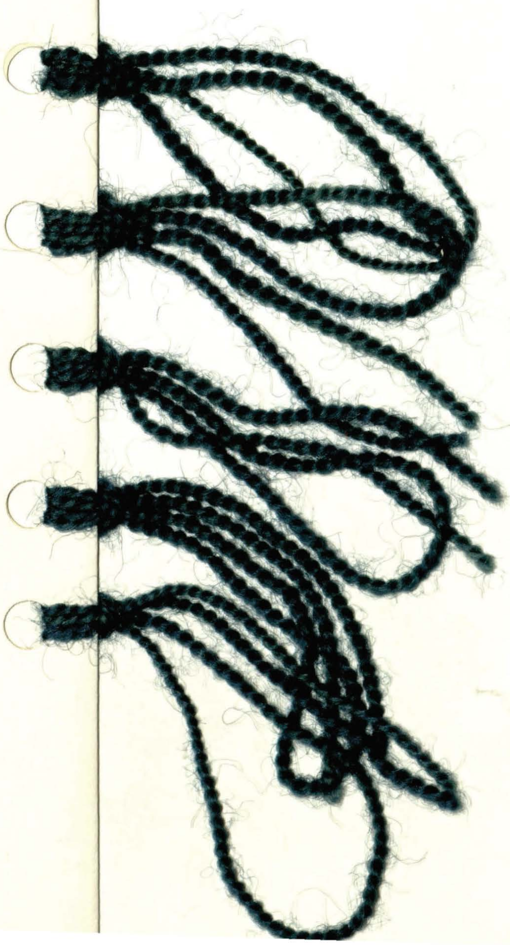
APPENDIX E

Yarns Dyed

Vegetal dyed yarns

APPENDIX F

Tested Dyed Yarns

Fade Test - indigo, synthetic

Control sample

1 year sample

2 year sample

3 year sample

4 year sample

Fade Test - indigo, fustic

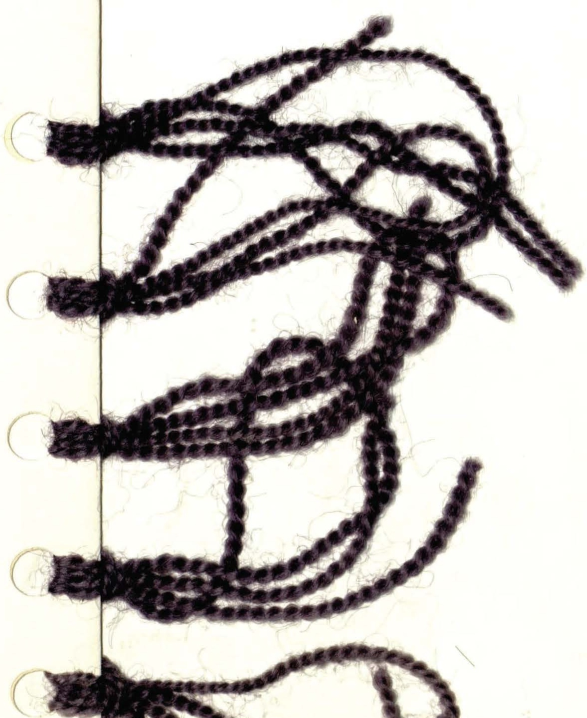
Control sample

1 year sample

2 year sample

3 year sample

4 year sample



Fade Test - fustic crystals 2%

Control sample

1 year sample

2 year sample

3 year sample

4 year sample

Fade Test - logwood sawdust

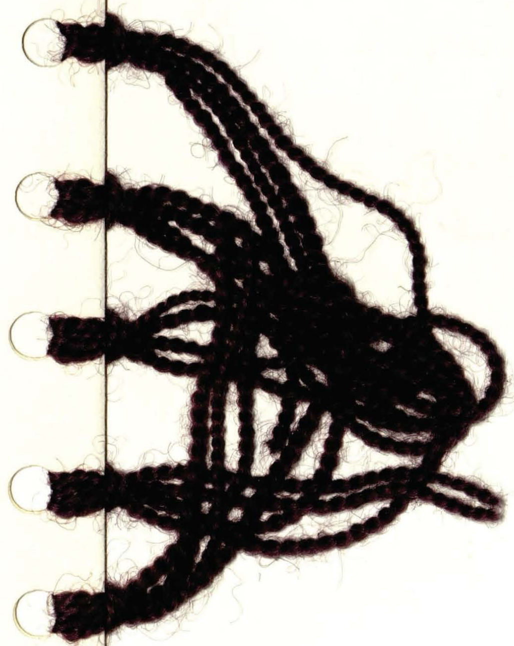
Control sample

1 year sample

2 year sample

3 year sample

4 year sample



Fade Test - cochineal 6.25%/
logwood 9%/

Control sample

1 year sample

2 year sample

3 year sample

4 year sample

Fade Test - madder 20%/
butternut 50%

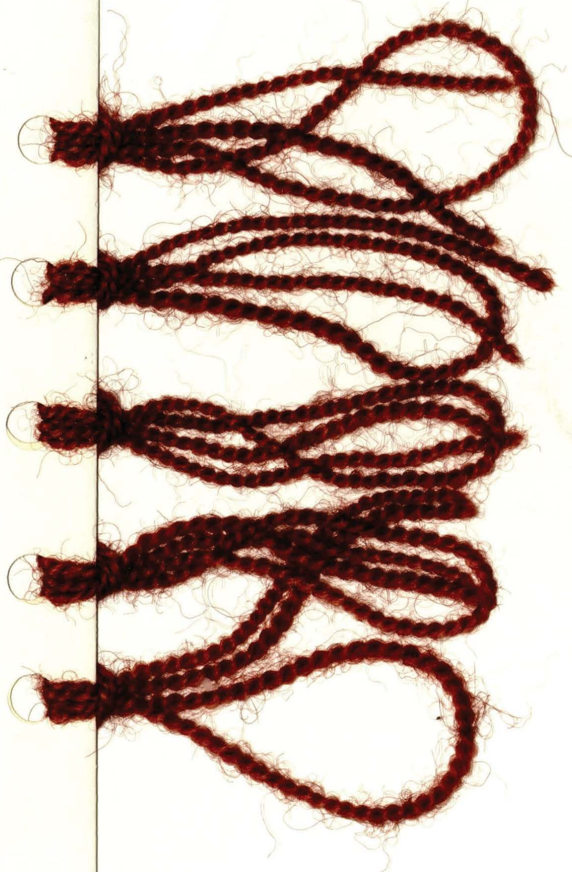
Control sample

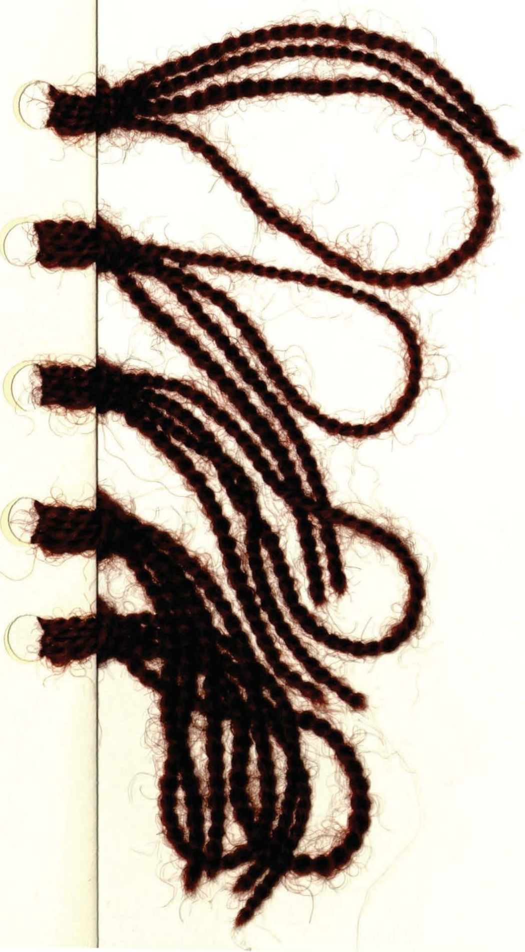
1 year sample

2 year sample

3 year sample

4 year sample





Fade Test - brazilwood 7.5%/
osage orange 2.5%/
cochineal 12.5%

Control sample

1 year sample

2 year sample

3 year sample

4 year sample

Fade Test - brazilwood crystals 15%

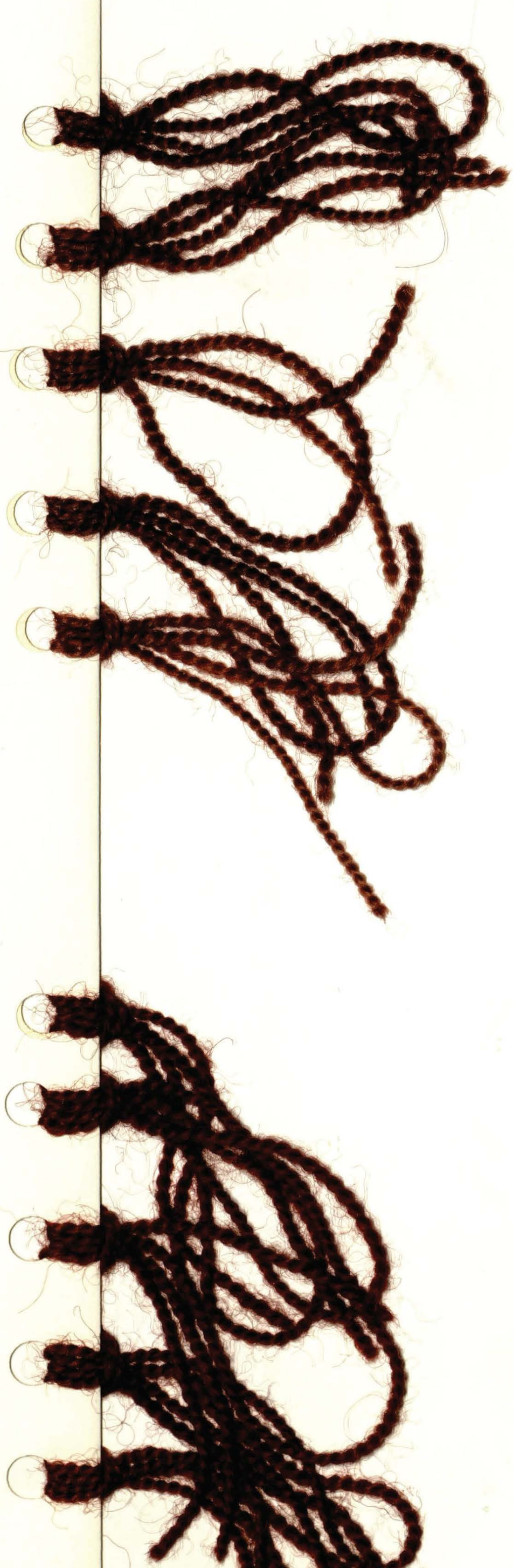
Control sample

1 year sample

2 year sample

3 year sample

4 year sample



Fade Test - madder powder 23%

Control sample

1 year sample

2 year sample

3 year sample

4 year sample

Fade Test - madder/cutch/
cochineal

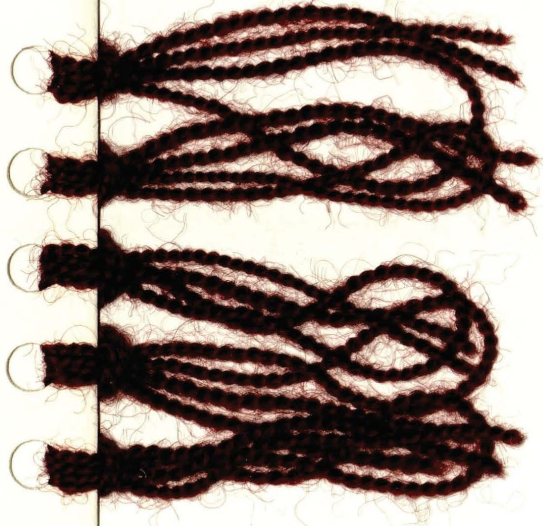
Control sample

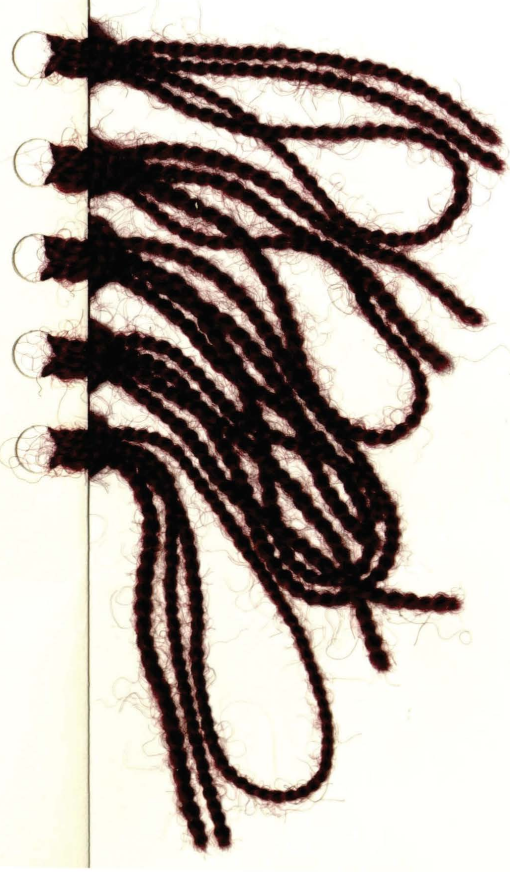
1 year sample

2 year sample

3 year sample

4 year sample





Fade Test - logwood stock 22.5%

Control sample

1 year sample

2 year sample

3 year sample

4 year sample

Fade Test - fustic 15%/logwood 1%/cochineal 12.5%

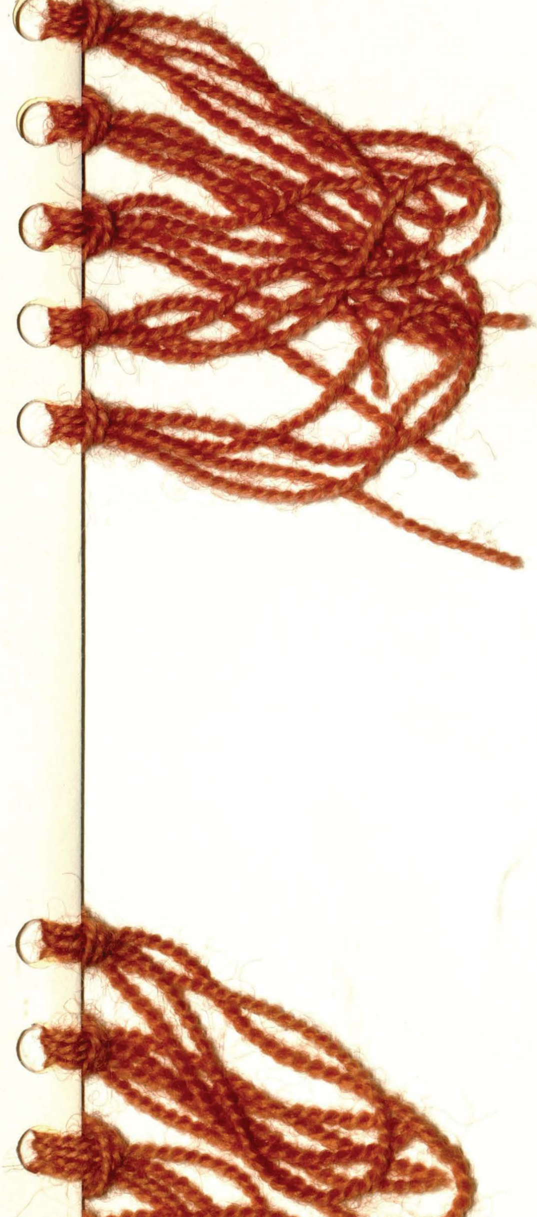
Control sample

1 year sample

2 year sample

3 year sample

4 year sample



Fade Test - ground cochineal
12.5%

Control sample

1 year sample

2 year sample

3 year sample

4 year sample

Fade Test - ground cochineal
12.5%, logwood 1%

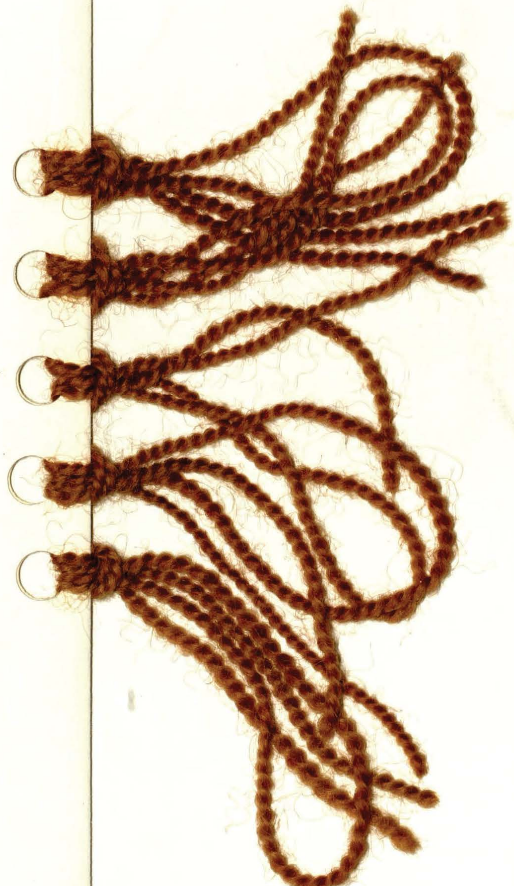
Control sample

1 year sample

2 year sample

3 year sample

4 year sample



Fade Test - madder crystals 15%/
logwood 6.25%

Control sample

1 year sample

2 year sample

3 year sample

4 year sample

Fade Test - ground madder 17%

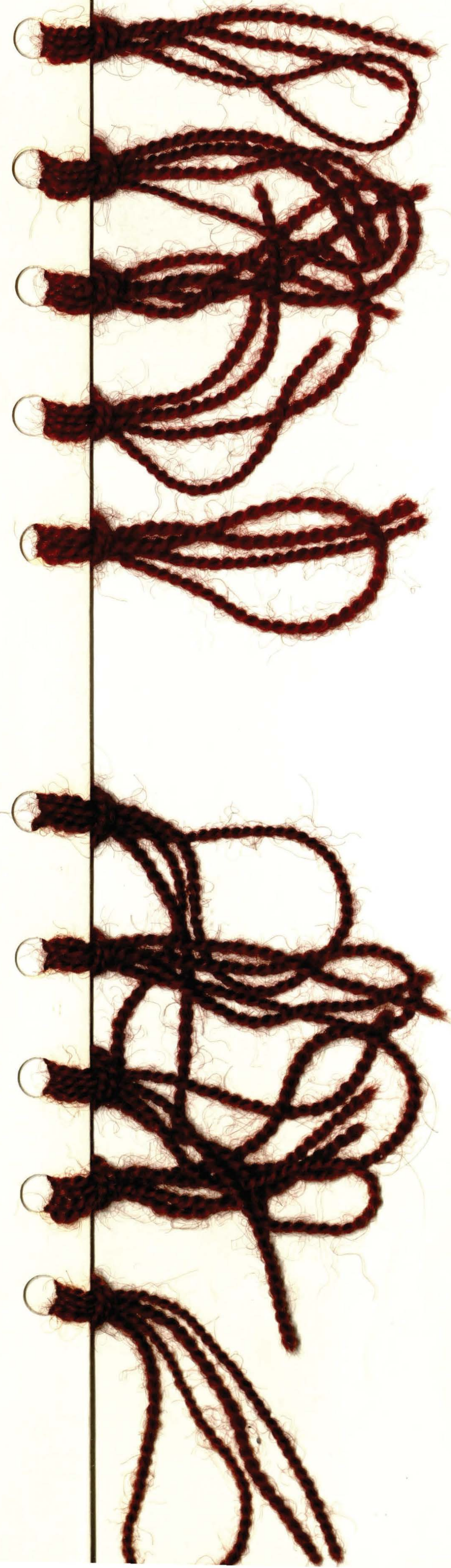
Control sample

1 year sample

2 year sample

3 year sample

4 year sample



Fade Test - brazilwood crystals 15%
w/alum and club moss
mordant

Control sample

1 year sample

2 year sample

3 year sample

4 year sample

Fade Test - fustic 1.59%/madder 20%

Control sample

1 year sample

2 year sample

3 year sample

4 year sample