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Development And Acceptability of Banana (Esp. Damilig-Musa Acuminata) Fiber as Alternative Source of Natural Fabric

JOMAR PAGGAO CRISTOBAL
ISABELA STATE UNIVERSITY- ILAGAN CAMPUS

ABSTRACT: Banana fiber yarn is a natural best fiber derived from the inner bark (or phloem) of banana plants. It is a very eco-friendly material, which also has the advantage of being completely biodegradable. This yarn is also known as banana silk, due to the shiny and silky aspect of the most precious fibers, or Musa yarn, from the Musa genre to which the banana plant belongs.
The study will focus on the Development and Acceptability of Banana (Esp. Damilig-Musa Acuminata) Fiber as Alternative Source of Natural Fabric. The panel of experts will evaluate the following namely: DOST personnel, Garments instructor, fashion designer/ textile experts and Faculty and garments fashion and design students of Isabela State University – Ilagan Campus.

The purpose of this research is to develop and test the effectiveness of banana (Damilig-musa acuminata), specifically its pseudo-stem. The researcher aims to unlock the following queries:

1. What are the processes used in the production of yarn?
2. What will be the outcome of the develop banana (Damilig-musa acuminata) after the process of fiber extraction in terms of texture, appearance and durability.
3. What will be the assessment and acceptability of the banana yarn (Damilig-musa acuminata) after weaving process is completed in terms of colorfastness, crease resistant and fabric shrinkage

The descriptive type of research will applied in the study with the set of survey questionnaire as the main instrument in gathering data. The weighted mean will also utilizes to determine the general acceptability of the study. The study will use the five-point Likert rating scale.

The process will conduct in accordance to Development and Acceptability of Banana (Esp. Damilig-Musa Acuminata) Fiber as Alternative Source of Natural Fabric. The procedures are harvesting, peeling, retting, and sun drying, grouping, spinning and weaving.

Evaluation results will show that the project obtained an overall mean of 4.38 to the development of fiber and 3.45 to the level of acceptability of fabric which means that the Development and Acceptability of Banana (Esp. Damilig-Musa Acuminata) Fiber as Alternative Source of Natural Fabric is Moderately Acceptable to the panel of experts based on the criteria checklist.

Based on the results of the experiments, it can be concluded that banana fibers can be used as an alternative source of natural fibers because they have several inherent advantages over cotton fiber. Because of the abundance of raw material in nature each year, banana fiber-based yarns and fabrics are less expensive and more sustainable. Because of the low fiber weight and strength loss, softening banana fibers by boiling in distilled water was found to be a better treatment.

KEYWORDS: Agro-based fibers, banana fibers, banana pseudo-stem, biodegradable, cellulosic, decorticator, environmentally friendly, Musa, natural fiber, renewable fiber, retting, sustainable

INTRODUCTION

As the fashion industry gears up for a future where textile resources are limited, natural fibers like cotton, which is still a resource-intensive material, and petroleum-based fibers like acrylic, polyester, nylon, and spandex remain in high demand. However, as the production of these fibers continues to cause irreversible damage to the environment, an increasing number of businesses are looking for sustainable alternative fibers and fabrics.

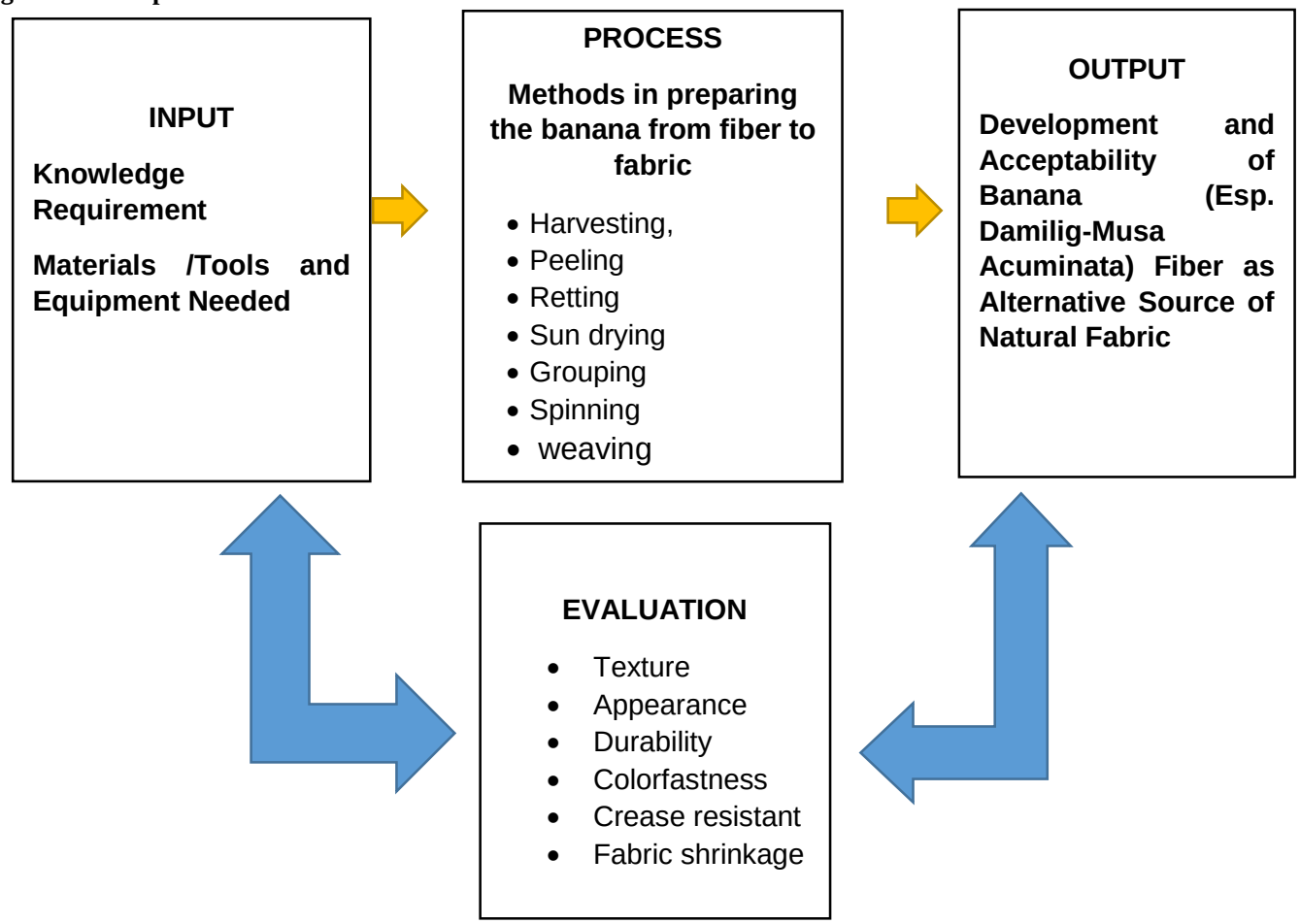
In fact, banana fiber, also known as Musa fiber, is one of the strongest natural fibers in the world. The natural fiber is biodegradable and made from the stem of the banana tree. It is extremely durable. The fiber is made up of thick-walled cell tissue that is bonded together by natural gums and is primarily made up of cellulose, hemicelluloses, and lignin. Banana fiber is similar to natural bamboo fiber, but it is said to have better spin ability, fineness, and tensile strength. Banana fiber can be used to make a variety of textiles with varying weights and thicknesses, depending on which part of the banana stem the fiber was extracted from. The outer sheaths of banana trees yield thicker, sturdier fibers, whereas the inner sheaths yield softer fibers.

Furthermore, bananas are one of the most popular and important fruit crops grown by individuals in tropical regions around the world. Because the Philippines, and particularly Isabela, is an agrarian province, it generates a large amount of agricultural waste each year from its production process, the majority of which goes unutilized and is thrown into the environment, causing pollution to soil, air, and water bodies. Many countries, however, convert waste into new sources of valuable resources for their countries. However, it is unfortunate that in our country, most of the agricultural waste is still left unchecked, polluting the environment.

As a result, the researcher began to research in order to develop and demonstrate the acceptability of banana fiber, especially Damilig fiber, as an alternative source of natural fabrics that could help each farmer sell the fibers while also assisting entrepreneurs in developing a durable yet eco-friendly textile.

CONCEPTUAL FRAMEWORK

Figure 1. Conceptual framework



The conceptual model, as shown above, depicts the process of developing and accepting banana (esp. Damilig-musa acuminata) fiber as an alternative source of natural fabric and contributes to the solution of the problem in this study.

The input stage consists of the knowledge requirements and the materials, tools, and equipment that are needed for producing yarn from banana damilig. The second box is the process, which contains the method and process for making yarn.

Finally, the third box, or the output, shows the result of the development of banana yarn.

METHODOLOGY

A mix of qualitative and quantitative approaches was implemented in this study to provide an inclusive insight. It also includes the materials, tools, and equipment, developmental procedures, sensory evaluation statistical tools, and the conduct of the study on how to enhance and improve its quality.

Research Design

The study will make use of the Project Developmental Method (PMI), a systematic study where the researcher will develop a product by employing different processes and will evaluate it based on the approved criteria and product parameters.

Furthermore, the primary data collection tools will be a questionnaire checklist supplemented by unstructured interviews and the evaluation of a panel of experts.

Development And Acceptability of Banana (Esp. Damilig-Musa Acuminata) Fiber as Alternative Source of Natural Fabric

Product Development

Table 1. Materials, Tools, and Equipment

The following tools, equipment, and materials will be used during the course of the study:

Tools	Function
Cauldron	use to boiled banana stalk and fiber
Spatula	use to stir and remove cooked banana fiber
Bolo	for cutting stalk and scraping
Materials	
Banana Trunks	use for fiber medium
Equipment	
Weaving Equipment	use to weave fiber to make fabric

Developmental Procedure

Procedure in making Development and Acceptability of Banana (Esp. Damilig-Musa Acuminata) Fiber as Alternative Source of Natural Fabric.

1. Harvesting- cut down to the ground to make room for the next plant.
2. Peeling- the first step in the production of banana fibers is the peeling of the outer part (the green peel) of the pseudo stem of the plant. At this stage, we are basically left with the inner bark. Keep in mind that the “inner” you go in the bark, the softer and higher in quality the fibers are.
3. Retting-In the phloem, banana fibers are found as bundles of cellulose, hemicellulose, lignin, and up to 2% of pectin and waxes. Thus, the first step in the production of banana fibers consists of the extraction and separation of the cellulosic fibers from all the other substances. This process is known as retting.
4. Drying- the extracted fibers are usually bunched together and dried in the sun. At this stage, all fibers are together, there is no separation between high-quality fibers and low-quality ones.
5. Grouping- once the fibers are dry, it is much easier to physically separate them, and they can be grouped based on their thickness and quality. Fibers of the same group are knotted together to form a long strand.
6. Spinning-.fibers are spun into yarn and made ready to use!
7. Weaving - the final step of making fiber to fabric

RESULT AND FINDINGS

Product Description

Fig. 2 the develop banana (Damilig-musa acuminata) after the process of fiber extraction in terms of texture, appearance and durability.

This is an actual photo taken from banana (damilig) fiber with a shiny, silky, and white color. The texture is hard and stiff, and the fiber has a strong hold.

Fig. 3. The level of acceptability of the banana yarn (Damilig-musa acuminata) after weaving process is completed in terms of colorfastness, crease resistant and fabric shrinkage.

This is an actual photo taken from banana (damilig) fabric, which is a good substitute for any kind of natural fabric.

Evaluation

Profession	Population
DOST Personnel	10
Garments Instructor/ Faculty	5
GFD Students	10
Fashion Designer/Textile Experts	5

Table 2.

The products will be tested and evaluated.Thirty (30) evaluators consisting of ten (10) DOST personnel, ten (10) college GFD students, five (5) garments instructors/faculty members of Isabela State University Ilagan Campus, and five (5) fashion designers/textile experts will be selected and properly oriented on what and how to evaluate the products using rubrics. The samples will be arranged on the table, and they will be evaluated by the respondents.

Statistical Tool

Scale	Numerical Rating	Descriptive Rating
5	4.50 - 5.00	highly Acceptable
4	3.50 – 4.49	moderately Acceptable
3	2.50 – 3.49	Acceptable
2	1.50 – 2.49	Slightly Acceptable
1	1.00 – 1. 49	not Acceptable

Table 3. Five – Points Likers Scale

Product Testing

The Researcher will conduct testing to measures the durability characteristics of the fiber

Fig. 1.1 Soaking Test (Yarn and Fabric)

Fig. 1.2 Stretching Test (Yarn and Fabric)

Fig. 1.3 Ironing Test (Yarn and Fabric)

Fig. 1.4 Burning Test (Yarn and Fabric)

Fig. 1.5 Detergent and Bleaching Test (Yarn and Fabric)

Fig. 1.6 Burning Test (Yarn and Fabric)

Product Evaluation

Table 4. Develop banana (Damilig-musa acuminata) after the process of fiber extraction in terms of appearance.

Appearance	Mean	Qualitative Description
The fiber is silky in color	4.27	Moderately Acceptable
Color discoloration on fiber	3.93	Moderately Acceptable
The develop fiber becomes vibrant when expose to light	4.3	Moderately Acceptable
OVERALL	**4.16**	**Moderately Acceptable**

SAMPLE DATA GATHERING

APPEARANCE								
NO.	5 (F*5)	4 (F*4)	3 (F *3)	2 (f*2)	1 (F*1)			
1	12	15	2	1	0			
2	8	14	6	2	0			
3	15	11	2	2	0			
						TOTAL/30	**MEAN**	**Visual Interpretation**
	60	60	6	2	0	128	4.27	MA
	40	56	18	4	0	118	3.93	MA
	75	44	6	4	0	129	4.3	MA

The table depicts the weighted mean appearance of Develop banana (Damilig-musa acuminata) following the fiber extraction process. The table further implies that the developed fiber becomes vibrant when exposed to light with the highest mean of 4.3, the fiber is silky in color with a mean of 4.27, and color discoloration on the fiber is 3.93; all of these had a qualitative description of "moderately acceptable." The computed mean was 4.16, which implies that the fiber is "Moderately Acceptable" in terms of appearance.

Table 5. Develop banana (Damilig-musa acuminata) after the process of fiber extraction in terms of durability.

Durability	**Mean**	**Qualitative Description**
The banana Fiber can easily break when applying heat	4.43	Moderately Acceptable
the fiber has the capacity to stretch	4.4	Moderately Acceptable
the fiber cannot easily deform when subjected to tension	4.4	Moderately Acceptable
OVERALL	**4.41**	**Moderately Acceptable**

SAMPLE DATA GATHERING

DURABILITY								
NO.	5 (F*5)	4 (F*4)	3 (F *3)	2 (f*2)	1 (F*1)			
1	18	8	3	1	0			
2	16	10	4	0	0			
3	18	6	6	0	0			
						TOTAL/30	**MEAN**	**Visual Interpretation**
	90	32	9	2	0	133	4.43	MA
	80	40	12	0	0	132	4.4	MA
	90	24	18	0	0	132	4.4	MA

In terms of durability, the table shows the weighted mean of developed banana (Damilig-musa acuminata) after the fiber extraction process. The table further implies that the fiber has the capacity to stretch and that the fiber cannot easily deform when subjected to tension; with the highest mean of 4.4, the banana Fiber can easily break when applying heat; with a mean of 4.43, all of these had a qualitative description of moderately acceptable. The computed mean was 4.41, which implies that the fiber is "moderately acceptable" in terms of durability.

Table 6. Develop banana (Damilig-musa acuminata) after the process of fiber extraction in terms of texture.

Texture	**Mean**	**Qualitative Description**
the fiber is rough and hard	4.47	Moderately Acceptable
the fiber is soft and stiff	4.73	highly Acceptable
the fiber is firm and rigid	4.53	highly Acceptable
OVERALL	**4.57**	**highly Acceptable**

SAMPLE DATA GATHERING

TEXTURE								
NO.	5 (F*5)	4 (F*4)	3 (F *3)	2 (f*2)	1 (F*1)			
1	16	13	0	1	0			

2	23	6	1	0	0			
3	19	8	3	0	0			
						TOTAL/30	**MEAN**	**Visual Interpretation**
	80	52	0	2	0	134	4.47	MA
	115	24	3	0	0	142	4.73	HA
	95	32	9	0	0	136	4.53	HA

The table displays the weighted mean texture of Develop banana (Damilig-musa acuminata) after the fiber extraction process. The table further implies that the fiber is soft and stiff with the highest mean of 4.73, the fiber is firm and rigid with a mean of 4.53, and the fiber is rough and hard with a mean of 4.47, all of which have a qualitative description of "highly acceptable." The computed mean was 4.57, which implies that the fiber is "highly acceptable" in terms of texture.

Summary of ratings given by respondents on Develop banana (Damilig-musa acuminata) after the process of fiber extraction in terms of appearance, durability and texture.

Table 7. The General ratings on the Develop completed product

Criteria	**Grand Mean**	**Qualitative Description**
Appearance	4.16	Moderately Acceptable
Durability	4.41	Moderately Acceptable
Texture	4.57	Highly Acceptable
Overall Mean	**4.38**	**Moderately Acceptable**

As shown in Table 7, the completed banana fiber received a mean of 4.57 for appearance, 4.41 for durability, and 4.16 for texture. In all criteria presented, the respondent rated the developed banana fiber as moderately acceptable. The computed overall mean was 4.38, which suggests that the banana fiber is "Moderately Acceptable."

Table 8. The level of acceptability of the banana yarn to fabric in terms of colorfastness.

Colorfastness	**Mean**	**Qualitative Description**
the materials not change its color even after wash	2.6	Acceptable
fabric get soiled or stained to accompanying materials	2.07	Slightly Acceptable
fabric fading	2.33	Slightly Acceptable
OVERALL	**2.33**	**Slightly Acceptable**

SAMPLE DATA GATHERING

COLORFASTNESS								
NO.	5 (F*5)	4 (F*4)	3 (F *3)	2 (f*2)	1 (F*1)			
1	2	5	5	15	3			
2	0	2	3	20	5			
3	0	5	5	15	5			
						TOTAL/30	**MEAN**	**Visual Interpretation**
	10	20	15	30	3	78	2.6	A
	0	8	9	40	5	62	2.07	SA
	0	20	15	30	5	70	2.33	SA

The table shows the weighted mean of the level of acceptability of the banana yarn to fabric in terms of colorfastness. The table further implies that the materials do not change their color even after washing, with the highest mean of 2.6, the fabric fading with a mean of 2.33, and the fabric getting soiled or stained for accompanying materials of 2.07.The computed mean was 2.33, which implies that the fabric is "slightly acceptable" in terms of colorfastness.

Table 9. The level of acceptability of the banana yarn to fabric in terms of crease resistant.

Crease Resistant	**Mean**	**Qualitative Description**
materials has single sharp crease (fix Deformation)	4.27	Moderately Acceptable
materials has largely creases or wrinkles random Deformation	2.07	Slightly Acceptable

material has its own crease recovery	4.47	Moderately Acceptable
OVERALL	**3.60**	**Moderately Acceptable**

SAMPLE DATA GATHERING

CREASE RESISTANT								
NO.	5 (F*5)	4 (F*4)	3 (F *3)	2 (f*2)	1 (F*1)			
1	15	10	3	2	0			
2	0	2	3	20	5			
3	16	13	0	1	0			
						TOTAL/30	**MEAN**	**Visual Interpretation**
	75	40	9	4	0	128	4.27	MA
	0	8	9	40	5	62	2.07	SA
	80	52	0	2	0	134	4.47	MA

The table shows the weighted mean of the level of acceptability of the banana yarn to fabric in terms of crease resistance. The table also indicates that the material has its own crease recovery with the highest mean of 4.47, a single sharp crease (fix deformation) of 4.27, and a largely creases or wrinkles random deformation of 2.07 mean, with the computed mean of 3.60 implying that the fabric is "moderately acceptable" in terms of crease resistance.

Table 10. The level of acceptability of the banana yarn to fabric in terms of fabric shrinkage.

Fabric Shrinkage	**Mean**	**Qualitative Description**
materials subjected to plus shrinkage expansion	4.27	Moderately Acceptable
materials subjected to minus shrinkage Contraction	4.53	Highly Acceptable
materials deform or change in dimension after Dry Clean Laundry	4.5	Highly Acceptable
OVERALL	**4.43**	**Moderately Acceptable**

SAMPLE DATA GATHERING

FABRIC SHRINKAGE								
NO.	5 (F*5)	4 (F*4)	3 (F *3)	2 (f*2)	1 (F*1)			
1	15	10	3	2	0			
2	19	8	3	0	0			
3	18	8	4	0	0			
						TOTAL/30	**MEAN**	**Visual Interpretation**
	75	40	9	4	0	128	4.27	MA
	95	32	9	0	0	136	4.53	HA
	90	32	12	0	0	134	4.5	HA

The table shows the weighted mean of the level of acceptability of the banana yarn to fabric in terms of fabric shrinkage. The table further implies that materials subjected to minus-shrinkage contraction and materials that deform or change in dimension after dry cleaning laundry have the highest mean of 4.5, while materials subjected to plus-shrinkage expansion have a 4.27 mean. The computed mean was 4.43, which implies that the fabric is "moderately acceptable" in terms of fabric shrinkage.

Summary of ratings given by respondents on the level of acceptability of the banana yarn (Damilig-musa acuminata) after weaving process is completed in terms of colorfastness, crease resistant and fabric shrinkage.

Table 11. The General level of acceptability of completed product.

Criteria	**Grand Mean**	**Qualitative Description**
Colorfastness	2.33	Slightly Acceptable
Crease Resistant	3.6	Moderately Acceptable
Fabric Shrinkage.	4.43	Moderately Acceptable
Overall Mean	**3.45**	**Moderately Acceptable**

As shown in Table 11, the completed banana fabric received a mean of 4.43 in fabric shrinkage, 3.6 crease resistance, and 2.33 in colorfastness. In all criteria presented, the respondent perceived the level of acceptability of banana fabric to be moderately acceptable. The computed overall mean was 3.45, which suggests that the banana fabric is "Moderately Acceptable."

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents a summary of the research work undertaken, the conclusions drawn, and the recommendations made as an outgrowth of this study. This study focused on the development and acceptability of banana (Esp. Damilig-Musa Acuminata) fiber as an alternative source of natural fabric.

The study aimed to find out the following outcomes:

The banana (Damilig-musa acuminata) develops in terms of texture, appearance, and durability after the process of fiber extraction.

1. In terms of level of appearance, the sample product got an overall mean of 4.16 with a qualitative description of "moderately acceptable," as perceived by the respondents.
2. In terms of level of durability, the sample product got an overall mean of 4.41 with a qualitative description of "moderately acceptable" as perceived by the respondents.
3. In terms of texture level, the sample product got an overall mean of 4.57 with a qualitative description of "highly acceptable" as perceived by the respondents.

The acceptability of the banana yarn (Damilig-musa acuminata) after the weaving process is completed in terms of colorfastness, crease resistance, and fabric shrinkage

1. In terms of level of colorfastness, the sample product got an overall mean of 2.33 with a qualitative description of "moderately acceptable," as perceived by the respondents.
2. In terms of level of crease resistance, the sample product got an overall mean of 3.6 with a qualitative description of "moderately acceptable" as perceived by the respondents.
3. In terms of level of fabric shrinkage, the sample product got an overall mean of 4.43 with a qualitative description of "moderately acceptable," as perceived by the respondents.

CONCLUSION

As for the findings of the study, the developed banana (Damilig-musa acuminata) after the process of fiber extraction in terms of texture, appearance, and durability has an overall qualitative description of moderately acceptable, just as the level of acceptability of the banana yarn (Damilig-musa acuminata) after the weaving process is complete in terms of colorfastness, crease resistance, and fabric shrinkage.

RECOMMENDATION

Base on the findings and conclusions presented the following are recommendation are suggested:

1. Man power
2. Banana plantation
3. Future researcher

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