
Development and Acceptability of Yarn from Adams Needle (*Yucca Filamentosa*) Plant as Vegan Textile

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ABSTRACT: This study will mainly focus on the development and acceptability of extracted fiber from Adam's needle plant, specifically from its spiked leaves, as a vegan textile. This groundbreaking study aims to revolutionize the fashion and textile sectors by investigating the potential of this plant's fiber through the project development method. Three groups were selected using the purposive sampling technique by choosing members of the industry to participate in our surveys, which included 5 garment faculty/instructors, 15 Regional Yarn Production and Innovation Center (RYPIC) staff, and 5 loom weavers/textile experts, for a total of 25 respondents. The describe-method of research was used with the sets of questionnaire-checklists supplemented by unstructured interviews and observations as the gathering instrument. A five-point Likert rating scale was used to determine the descriptive meaning of the indicators of the variables used. The weighted mean was also utilized to determine the general acceptability of Adam's needle fiber.

Here is the summary of the level of acceptability of yarn, which has an overall mean of 4.38 for faculty members, an overall mean of 4.24 for weavers and experts, and an overall mean of 4.20 for the RYPIC. According to the evaluation results, indicating that Adam's needle (*yucca filamentosa* yarn) is "**moderately acceptable**," it passed the evaluation of the three groups of respondents in terms of appearance, texture, and durability.

KEYWORDS: fiber, vegan, acceptability, characterization, plant, yarn, evaluation, observations, gathering, method

INTRODUCTION

Yucca filamentosa, commonly called Adam's needle, Spanish bayonet, yucca and needle palm, is a virtually stem less broadleaf evergreen shrub (though it looks more like a perennial than a shrub) that is native to beaches, sand dunes and fields from South Carolina south to Florida and Mississippi. It has escaped cultivation and extended its original range north into New England. It features a basal rosette of rigid, sword-shaped, spine-tipped green leaves (to 30" long and to 4" wide) with long filamentous (as per specific epithet) curly threads along the margins. Leaves form a foliage clump to 2-3' tall. In late spring, a flowering stalk rises from the center of each rosette, typically to 5-8' tall, but infrequently to 12' tall, bearing a long terminal panicles of nodding bell-shaped creamy white flowers. Fruits are elliptical dehiscent capsules. This plant is most commonly found in sandy soils, especially in beach scrub and dunes, but also in fields, barrens, and rocky slopes, though it grows well also in silt or clay soils. Easily grown in light, dry to medium, well-drained soils in full sun but tolerant of poor, sandy soils, heat, drought, and salt spray. Surprising tolerance for some part shade and it can be propagated easily from basal offsets.

Due to the overproduced plant of *Yucca filamentosa* in the tropical country like the Philippines, *Yucca filamentosa* were simply wasted, motivating researchers to carry out this study. The purpose of this research was to demonstrate the capability of *Yucca filamentosa* fiber for apparel other than fabric.

Natural fibers are very much in demand especially among consumers. They are very popular in terms of soft surface and comfortable to wear. However, higher production costs, especially compared to synthetic fabrics. The characteristics are static, that is, they cannot be improved without the aid of chemicals. Thus, the extraction of fibre from *Yucca filamentosa* to make natural textile will enable consumers to decrease their dependence on fabric using synthetic fibre by offering similar advantages through paper. This product will also help address the overproduction problem of the plant due to uncontrolled plant propagation. Waste *Yucca filamentosa* leaves are used to make the fiber, which is the starting point for spinning regenerated natural cellulose fiber. By effectively reusing biological resources, providing certain environmental meanings, expanding the sources of raw materials for spinning, and improving the ecological, economic, and social benefits of adams' needle plantation.

The intent of this study is to contribute to raising awareness about the capability of *Yucca filamentosa* as a natural fabric, with the hope of helping preserve the leaves and the production of Vegan fabrics in the Philippines.

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LITERATURE REVIEW

The Yucca Plant Adam's needle yucca (genus *Yucca*), a genus of about 40 species of succulent plants in the agave subfamily of the asparagus family (*Asparagaceae*), is native to southern North America. Most species of yucca are stemless, with a rosette of stiff sword-shaped leaves at the base and clusters of waxy white flowers. Adam's needle is a virtually stemless shrub with blade-like leaves that form a basal rosette. The foliage clumps are usually 2 to 3 feet tall, with curled threads lining the edges of the leaves, giving it its species name—filamentosa—for its threads or "filaments. Adam's needle (*Y. filamentosa*) is commonly cultivated as ornamentals for their unusual appearance and attractive flower clusters (Petruzzello, 2023). A sample of yucca plant is shown in fig. 1.



Figure 1. The Yucca Plant (Adam's Needle leaves)

The Yucca Plant in the Philippines

In the Philippines, yuccas are appreciated for their ability to adapt to both tropical and semi-arid climates, making them versatile for various landscape designs. They are often incorporated in Filipino garden settings as part of a landscape, which reduces the need for water. The structural form of yucca plants complements modern Filipino architecture, which often includes elements of angular, geometric lines and open spaces. The yucca's height and form offer a visual contrast to the lush, more rounded foliage typically found in tropical gardens, thus enhancing the aesthetic of minimalistic and contemporary Filipino designs.

Yucca as Sustainable Materials

According to H.M. Nascimento et.al (December 15,2021) The use of fibers chemically extracted from the leaves of Yucca as reinforcement in polymeric matrix composites of polypropylene was investigated. The fibers were extracted by mercerization by varying the temperature, time, and NaOH concentration to obtain fibers with a balanced relationship between mechanical, chemical, thermal, and morphological properties that promote their use in polymer matrix composites. The fibers were characterized by tensile testing, scanning electron microscopy (SEM), attenuated total reflection-Fourier transform infrared spectroscopy, X-ray diffraction, chemical composition, and thermo gravimetric analysis.

CONCEPTUAL FRAMEWORK

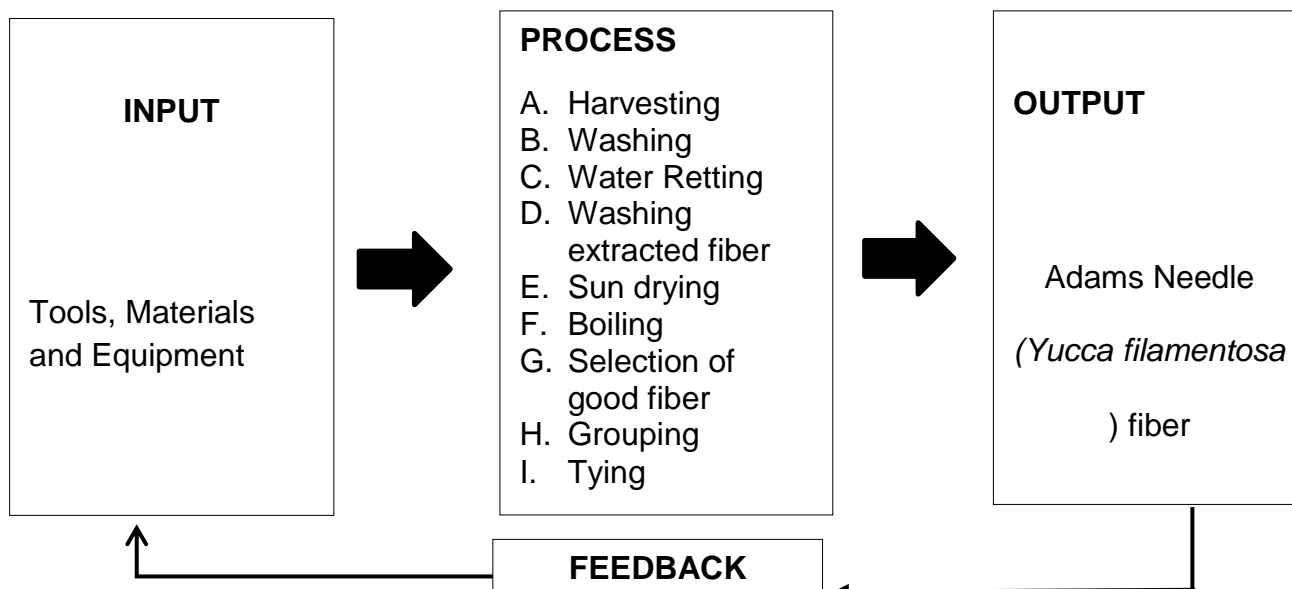


Figure 2. Shows the different stages through which the study shall proceed

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MATERIALS:

A. Supplies and Materials

In order to perform the study the following materials shall be used is shown on the table below;

Table 1. List of Supplies and Materials

QUANTITY	UNIT	NAME AND DESCRIPTION
5	Kg	Yucca filamentosa
10	Pieces	Cone

B. Tools and Equipment

The following are tools and equipment needed in Extraction of *Yucca filamentosa* fiber as a natural fabric.

Table 2. List of Tools and Equipment

TOOLS	FUNCTIONS
Cauldron	Use to boil the Yucca filamentosafiber.
Stove	To help cauldron to boil the Yucca filamentosa.
Rolling pin	Use to remove the water in extracting the Yucca filamentosa fiber.
Gloves	Use to protect hand during extraction, to avoid contamination in some procedure and for some safety precaution measures.
Knife	Use for scrapping the Yucca fiamentosa leaves.

METHOD:

The study made use of the Product Development Method (PDM). A systematic study where the researcher will develop a product by employing different process and will evaluate based on the approved criteria and product parameters. Furthermore, the primary data collection tool was a questionnaire checklist supplemented by sensory evaluation of panel of experts.

Extraction Procedure

- A. **Harvesting** - cut down to the ground to make room for the next plant.
- B. **Washing** -the act of cleaning the harvested stem for 30 minutes.
- C. **Water Retting** - the process of producing excellent fiber, the stem removed from the water before retting is completed and dried for two days.
- D. **Scrapping** - after extraction, the fibers are scrap with the used of scrapping tools.
- E. **Boiling** - boiling the extracted fiber to remove the bacteria from the fibers and to bring the natural color of the fiber for 10-15 minutes.
- F. **Sun Drying** - the extracted fibers are usually bunched together and dried in the sun. At this stage, there is no separation between high quality fibers and low quality ones.
- G. **Grouping** - once the fibers are dry, it is much easier to physically separate them and they can be grouped base on their thickness and quality fibers of the same group are knotted together to form a long strand.
- H. **Tying** – the extracted fiber is tied together.

Data Gathering Procedure

The respondents collected the data through face to face. Asses the respondents in answering all the questions that administer, meanwhile.

Moreover, the observation method was also applied to determine the whole structure of the project particularly its acceptability to the users. The data gathered through the administered and retrieve questionnaire-checklist from the respondents tallied. The researcher formulating questions appropriate for the study and all doing were modification to the chosen respondents. Twenty five (25) copies of questionnaires distributed were be successfully completed and returned. Thus, their corresponding answers to the question were kept in accordance with the agreement of the respondents and researchers. The respondents used first the innovative product before rating its acceptability. Moreover with evaluation method was also applied to determine the whole structure of the project particularly its acceptability to the users.

The data gathered were organized and tabulated according to the results of the statistical treatment done. In this stage the service of statistical consulted was needed.

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Statistical Treatment of Data

All data were gathered through questionnaire evaluation form given to the evaluations. The variable is analyzed and interpreted. The statistical tools used are the following;

1. Weighted Mean (M) is utilized the level of acceptability of the extracted fiber from *Yucca filamentosa* in terms of;
A. appearance
B. durability; and
C. texture

The statistical tools used in the study are as follows:

Weighted Mean. This was used to determine the level of acceptability to extracted fiber from Adams needle (*yucca filamentosa*) plant as regards on the three criteria: Appearance, Texture and Durability.

PRODUCT PRESENTATION

We made a yarn from adams needle (*yucca filamentosa*) plant to help in preserving the leaves and the production of Vegan fabrics in the Philippines. Offering job opportunities can be a source of income in garments and textile industry and can be additional product to all manufacturers.



Figure 3. Final Product

Product Capabilities and Limitations

The product was very helpful because it can help loom weavers to save money and get more income because yarn from adams needle is easy to make and it is very firm and durable. The product was used in sewing barong tagalog and baro't saya, for making mat, a hammock and for making a sash. The product is only used for formal attires and for making a durable materials like hammock.

Project Description

1. The develop product is mixed with synthetic fiber when weaving.
2. The develop product have a length of 30-centimeter and a width of 5-centimeter.
3. The cone have a length of 12-centimeter and a width of 3-4-centimeter.
4. The leaf has a length of 60-70-centimeter and a width of 3-centimeter.

Product Testing

The researchers conducted testing to measures the durability characteristics of the fiber.



Figure 4. Soaking Test

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The purpose of soaking was to check if there was a difference in appearance and durability by soaking in cold water for a day. According to observation, the yarn softened although the woven yarn's look remained same.



Figure 5. Stretching Test

The tension stretch of the weaved yarn result showed that it was sturdy and undamaged. While a half kilo of weight was used to stretch a length of yarn that was one (1) meter long. The yarn breaks between three, and five strands. Half kilogram of weight can be supported.



Figure 6. Ironing Test

As a result for the weaved yarn, from level 1 of the iron, It remained same level 2, it ironed well while in Level 3, it burns. As for the yarn, level 1, nothing happened, level 2, it turned black due to the stronger temperature.



Figure 7. Burning Test

Pointed at the flame for 3 seconds, the woven yarn only warmed up while the natural yarn turned black

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Figure 8. Detergent and Bleaching Test

Both are soaked in bleach in 5 hours. The woven yarn did not change anything while the non-weave yarn became a little transparent.

Level of Acceptability of Extracted Fiber from Adam's Needle

Appearance

Table 3 shows the evaluation of the three groups of respondents on the level of acceptability to extracted fiber from Adams needle (*yucca filamentosa*) plant in terms of Appearance.

Table 3 Respondents' Evaluations on the Acceptability Level of Extracted Fiber from Adam's Needle with regard to Appearance

Indicators	Respondents					
	Faculty		Weaver/Expert		RYPIC	
	WM	VI	WM	VI	WM	VI
1. The yucca fiber is silky in color	4.80	HA	4.67	HA	4.60	HA
2. Color Discoloration on fiber	4.20	MA	4.00	MA	4.40	MA
3. The develop fiber becomes vibrant when exposed to light	4.00	MA	3.73	MA	3.60	MA
Overall Weighted Mean	4.33	MA	4.13	MA	4.20	MA

Note: WM – Weighted Mean

VI – Verbal Interpretation

MA – Moderately Acceptable

HA – Highly Acceptable

As presented in the Table, the faculty members, weaver/expert and RYPIC evaluated all indicators interpreted as **Moderately Acceptable (MA)** with overall weighted mean of 4.33, 4.13 and 4.20, respectively.

This implies that the developed and acceptability of yarn from Adams needle (*yucca filamentosa*) indicators 2 and 3 were evaluated by the faculty, weaver/expert, and RYPIC respondents as Moderately Acceptable (MA). Meanwhile, Indicator 1 was evaluated by the three groups of respondents as highly acceptable (HA). Though the evaluation of the group of respondents varied from each other, still it was in the bracket of acceptability which was from Moderately Acceptable to Highly Acceptable. The developed and Acceptability of Yarn from Adams Needle (*Yucca Filamentosa*) was accepted when evaluated in the three indicators by the three groups of respondents as to Appearance.

Texture

Table 4 shows the evaluation of the three groups of respondents on the level of acceptability to extracted fiber from Adams needle (*Yucca Filamentosa*) plant in terms of Texture.

Table 4 Respondents' Evaluations on the Acceptability Level of Extracted Fiber from Adam's Needle with regard to Texture

Indicators	Respondents					
	Faculty		Weaver/Expert		RYPIC	
	WM	VI	WM	VI	WM	VI
1. The yucca fiber is soft and stiff	4.80	HA	4.87	HA	4.60	HA
2. The yucca fiber is firm and rigid	4.80	HA	4.93	HA	4.00	MA
3. The yucca fiber according to its grittiness	4.00	MA	3.87	MA	3.60	MA
Overall Weighted Mean	4.53	HA	4.56	HA	4.07	MA

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It shows on the Table 4 that the faculty members, weaver/expert, and RYPIC respondents rated the texture with an overall weighted mean 4.35, interpreted as Highly Acceptable (HA), 4.56 interpreted as Highly Acceptable (HA) and 4.07 interpreted as Moderately Acceptable (MA), respectively.

This implies that the developed and Acceptability of Yarn from Adams Needle (*Yucca Filamentosa*) indicators 1 and 2 were evaluated by the faculty members and weaver/expert respondents as Highly Acceptable. For the RYPIC respondents indicator 1 also interpreted as Highly Acceptable. And as for the rest of indicators when interpreted were found to be Moderately Acceptable, respectively. Though the evaluations of the three groups of respondents vary from each other, still it is in the bracket of acceptability. Then the developed and Acceptability of Yarn from Adams Needle (*Yucca Filamentosa*) is accepted on the three indicators by the three groups of respondents as to Texture.

Durability

Table 5 exhibits the three groups of respondents' evaluation on the level of acceptability to extracted fiber from Adams needle (*Yucca Filamentosa*) plant regarding of Durability.

Table 5 Respondents' Evaluations on the Acceptability Level of Extracted Fiber from Adam's Needle with regard to Durability

Indicators	Respondents					
	Faculty		Weaver/Expert		RYPIC	
	WM	VI	WM	VI	WM	VI
1. The yucca fiber is strong	5.00	HA	5.00	HA	5.00	HA
2. The yucca fiber cannot easily deform when subjected to tension	4.20	MA	4.00	MA	4.60	HA
3. The yucca fiber cannot easily break when applying heat	3.60	MA	3.07	A	3.40	A
Overall Weighted Mean	4.27	MA	4.02	MA	4.33	MA

Based on table 5, the faculty members, weaver/expert, and RYPIC respondents rated the Durability with an overall weighted mean of 4.47 which was interpreted as Moderately Acceptable (MA), 4.02 interpreted as Moderately Acceptable (MA), and 4.33 interpreted as Moderately Acceptable (MA), respectively. However, it was also clear that indicator 1 was rated by the three groups of respondents as Highly Acceptability only as expressed by the weighted mean 5.00, while the RYPIC respondents also rated indicator 2 as Highly Acceptable based on the weighted mean of 4.60. But the indicator 3 of weaver/expert and RYPIC was rated by Acceptable based on the weighted mean 3.07 and 3.40. And the rest indicators of the three group of respondents when evaluated by Moderately Acceptable, respectively. The developed and Acceptability of Yarn from Adams Needle (*Yucca Filamentosa*) is accepted in the three groups of respondents as to Durability.

Table 6 Summary of Respondents' Evaluations on the Acceptability Level of Extracted Fiber from Adam's Needle

Criteria	Respondents					
	Faculty		Weaver/Expert		RYPIC	
	OWM	VI	OWM	VI	OWM	VI
a. Appearance	4.33	MA	4.13	MA	4.20	MA
b. Texture	4.53	HA	4.56	HA	4.07	MA
c. Durability	4.27	MA	4.02	MA	4.33	MA
Grand Weighted Mean	4.38	MA	4.24	MA	4.20	MA

Note: OWM – Overall Weighted Mean

Based on Table 3, it can be observed that the three group of respondents have evaluated the developed and acceptability of yarn from Adams needle (*yucca filamentosa*) that the extracted yarn as Moderately Acceptable and Highly Acceptable.

Here is the summary of the level of acceptability of yarn, for faculty members which have an overall mean of 4.38 with the descriptive rating of Moderately Acceptable. For weaver/expert which have an overall mean of 4.24 with the descriptive rating of Moderately Acceptable. And as for the RYPIC, It obtained an overall mean of 4.20 with a descriptive rating of Moderately Acceptable.

It means that the finalized of the developed and acceptability of yarn from Adams needle (*yucca filamentosa*) passed the evaluation of the three groups of respondents in terms of Appearance, Texture and Durability.

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Summary

This study determined the capability of *Yucca filamentosa* fibre for textile industry. To achieve this, the researchers will extract fibres involving the harvesting, soaking, scraping, washing, drying and selecting good fiber which is followed by the weaving process. The developed product was constructed using knife, rolling pin and other components affordable and locally available that was suited for the yarn from Adams needle plant. Likewise, this study evaluations on developed and acceptability of yarn from Adams needle (*yucca filamentosa*) plant in terms of the mentioned criteria and the comments and suggestions of the respondents to further improve the study.

The describe-method of research was used with the sets of questionnaire-checklist supplemented by unstructured interview and observations as the gathering instrument. A five-point Likert rating scale was used to determine the descriptive meaning of the indicators of the variables used.

The Weighted Average Mean (WAM) was used to interpret the equivalent meanings of the data gathered.

CONCLUSION

Based on the findings of the study, the following conclusions were drawn:

1. The developed and acceptability of yarn from Adams needle (*yucca filamentosa*) plant was constructed using locally available materials.
2. The developed and acceptability of yarn from Adams needle (*yucca filamentosa*) plant was acceptable among the three groups of respondents in terms of appearance, texture and durability based on the results on the evaluation and level of acceptability.

RECOMMENDATIONS

To the future researchers, based on the fore mentioned findings and conclusions, the following recommendations are offered:

1. The Adams needle (*yucca filamentosa*) is has the potential to be used in different apparel/textiles.
2. It can be blended with synthetic yarn.
3. The fiber can also be used to make a hammock.
4. It is much better to twill the yarn to be able to make it stronger and can be used for crafts.

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