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Utilization of Malatarlak Grass (*Themeda Arundinacea*) as a Potential Material in Yarn Making

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Abstract: Themeda Arundinacea, also known as Malatarlak Grass, has qualities that can be used to make yarn. Due to the mass growth of malatarlak grass, researchers are exploring new materials, and this study investigates the potential of Malatarlak Grass as a yarn material. The researchers used manual methods to extract the fibers and tested them through crocheting, knitting, embroidery, and weaving to create a prototype. This helped evaluate the effectiveness of the fabric. The study used experimental research to test how changing certain factors affected the results. A One Sample T-test was applied to compare Malatarlak yarn with conventional yarn. The results showed that Malatarlak yarn has some similarities to conventional yarn, especially in terms of elongation and elasticity. The study suggests that more research should be done to improve the properties of Malatarlak Grass as a yarn material (Sicat, R. M., 2021).

Keywords: Malatarlak Grass (Themeda Arundinacea), Grass Fibers, Fibers, Yarn, and Yarn making.

I. INTRODUCTION

Yarns are vital components made up of short or long fibers that are mechanically interlocked to create strength. They play a crucial role in fabric processing, weaving, and rope making. Natural fiber yarns, such as twisted and non-twisted fibers, can be used as reinforcement in composites. Twisted yarns have fibers twisted together at an angle, commonly used in textiles, while non-twisted yarns have fibers aligned in the same direction and are held together by polymeric wrapping wire. This innovative design allows for better control of fiber orientation and increased loading, making it ideal for continuous production processes (Fan & Weclawski, 2019). In the process of yarn production, fibers undergo a series of crucial steps to transform into the versatile material that is used in various industries. Beginning with the cleaning, blending, and carding of fibers to ensure proper alignment, these preparatory processes are essential for producing high-quality yarn. Different spinning techniques, such as ring spinning, open end rotor spinning, and air jet spinning, are then utilized to create a diverse arrangement of yarn types like staple spun, monofilament, and multifilament yarns, each tailored to specific end-product requirements. Through meticulous attention to detail and precision, yarn manufacturers are able to produce yarns of exceptional quality for a wide range of applications (Ali, 2020).

Textile manufacturers are facing challenges with tension variation during the soft winding process, affecting yarn quality and ultimately impacting dyeing processes and water consumption (Mohamed, 2021). In 2018, the Environmental Protection Agency (EPA) reported that only 14.7% of textile waste in the United States was recycled, with a massive 11 million tons ending up in landfills, accounting for nearly 8% of ***all*** municipal solid waste. The textile industry, known for its heavy use of chemicals and extensive manufacturing processes, has been identified as a major contributor to environmental pollution. Textile production has a significant impact on the environment. Solid textile waste exacerbates these issues, posing a serious threat to the sustainability of fabric manufacturing. In response to this pressing concern, many companies are implementing strategies to recover waste fibers and reduce landfill waste, in an effort to minimize the environmental footprint of textile production (Phubmed Central, 2020). In the textile industry, yarn hairiness, which refers to the fibers sticking out from a yarn, is a critical factor impacting yarn quality and fabric production through knitting and weaving. High yarn hairiness can negatively affect important fabric properties like pilling resistance and abrasion resistance. Additionally, machinery used in textile production, such as warping, sizing, high-speed knitting, and weaving machines, can experience performance issues due to yarn hairiness. Managing yarn hairiness is crucial for ensuring the production of high-quality textiles (Sivakumar, S., 2020).

In the late 1950s, Marcos Tañedo and the Tarlac Historical Society proposed that Tarlac's name was linked to the indigenous cogon grass known as malatarlac. This theory was further celebrated with the creation of the Malatarlak Festival in Tarlac City, Philippines. This vibrant event showcases the beauty and versatility of the malatarlac grass through elaborate pageantry, traditional music, and festive gatherings that appeal to people of all ages. The malatarlac grass, with its qualities of producing natural fibers from its stems and adding strength and texture to yarn with its leaves, presents a promising opportunity for sustainable and renewable fiber production. Its ability to grow abundantly in colonies in clay loam soils makes it a valuable resource for supporting local livelihoods and promoting environmental conservation efforts. The Malatarlak Festival stands as a testament to the rich cultural heritage and natural wonders that Tarlac has to offer, celebrating the unique qualities of the malatarlac grass and the community's deep connection to the land (Dizon, R. 2023).

This study investigated the potential of Malatarlak Grass (Themeda Arundinacea) as a material for yarn production alongside conventional yarns by analyzing its properties, which referred to the visual perception of different wavelengths emitted by a material. In the context of yarn, it referred to the aspects of Malatarlak Grass in comparison to conventional yarns. Additionally, it described the potential effectiveness of Malatarlak Grass based on yarn appearance. Assessing its efficacy in techniques such as crocheting, knitting, weaving, and embroidery involved using a single hooked needle to interlock loops of yarn into a fabric, creating intricate designs or patterns. The findings provided insights into the suitability of Malatarlak Grass as a sustainable and versatile option for yarn production.

II. METHODOLOGY

The researchers utilized an experimental research method within the quantitative research design framework. Experimental research was a quantitative study approach that involved the collection of numerical data and statistical analysis to investigate research objectives. True experimental research was a rigorous method of testing hypotheses and determining causal relationships between variables. It involved manipulating an independent variable to observe its effects on a dependent variable while controlling for irrelevant variables. This method was powerful in testing hypotheses and establishing cause-effect relationships. True experiments also included a control group, comparing the treatment group to an experimental group without receiving the treatment, to ensure accurate results (Niza, K., 2018). The experimental research design provided a framework for conducting scientific research using two sets of variables, with the first set acting as a constant to measure differences. It aided in making better decisions and determining facts. A quality research design formed the foundation for a study, established quality decision-making procedures, facilitated data analysis, and addressed the main research question. It allowed researchers to organize, set boundaries, and increase reliability, preventing inconclusive results (Sirisilla, S., 2023). By using this design, the researchers determined the effectiveness of Malatarlak Grass (Themeda Arundinacea) as a potential material in yarn making. The experiment, conducted from April 2023 to 2024, examined the effectiveness of Malatarlak grass in yarn production by comparing dry and wet fiber rolling methods. In April 2024, researchers finalized their methodology, securing materials, estimating costs, and planning procedures before purchasing supplies and preparing samples. In the first trial, they collected Malatarlak grass with scissors and a machete, soaked it in distilled water, and extracted fibers using a lice comb. Initial rolling without boiling or fabric conditioner was difficult but adding fabric conditioner and briefly boiling at 100°C improved quality. Wet fibers performed better than dry ones, and yarn thickness was tested using 5 versus 10 fibers. In the second trial, boiling weakened the fibers, making them too fragile for rolling. In the third trial, researchers skipped boiling, manually extracted fibers, and measured yarn diameter with a ruler, successfully completing the process. They evaluated the yarn’s color, texture, flexibility, elongation, kinetic friction, thickness, tensile strength, and elasticity using a weighing scale, meter stick, and stone test for durability. The study was conducted in a specific location, with observations scheduled based on researchers’ availability over a two- to three-week period. The researchers used various research instruments and statistical tests to assess Malatarlak grass's potential as a yarn material. Research instruments, as defined by DiscoverPhDs (2020), included checklists, surveys, and tests to collect and analyze data. An observation checklist recorded whether specific traits were present in Malatarlak yarn (Niketa, 2019). A one-way ANOVA compared the variance in group means to analyze fiber length, strength, and elasticity among samples (Mackenzie, 2018), while a one-sample t-test determined if Malatarlak grass significantly differed from traditional yarn materials (De Winter, 2019). Descriptive statistics summarized the dataset using measures of central tendency (mean, median, mode) and variability (standard deviation, variance, range, kurtosis, skewness). Likert scale gauged user feedback on the yarn’s effectiveness in crocheting, knitting, weaving, and embroidery, covering aspects like ease of use, durability, and project quality (Bhandari, 2023). Additional questionnaires gathered responses from individuals testing Malatarlak yarn, ensuring a comprehensive evaluation of its textile applications.

III. RESULTS AND DISCUSSION

A. *Characteristics of malatarlak yarn in terms color, texture and flexibility.*

1) *Observational Checklist of Malatarlak Yarn (Themeda Arundinacea) in terms of Flexibility.*

The researchers tested the flexibility of the Malatarlak grass yarn and conventional yarn by varying its degrees and diameter. The researchers aim to analyze how it responds to bending and stretching.There are various types of yarn, and their texture depends on an individual's sense of touch. A large protractor can be used to test the flexibility of yarn or other objects effectively (Physics World, 2023). This study will provide valuable insights into the material's resilience and versatility and potentially uncover new applications in various industries.

Table 1: Flexibility Of Malatarlak Yarn

Sizes (Diameter)	Degrees						Remarks	
	0°-30°	30°-60°	60°-90°	90°-120°	120°-150°	150°-180°	Flexible	Not Flexible
2.25mm	/	/	/	/	/	/	/	
3.25mm	/	/	/	/	/	/	/	
4.25mm	/	/	/	/	/	/	/	

Table 1 presented a study on the flexibility of Malatarlak Grass, examining its response to bending and stretching at various degrees and diameters. The researchers aimed to analyze how the material's resilience and versatility varied with these factors, potentially uncovering new applications in different industries. The table showed that the flexibility of the grass was evaluated by testing its ability to bend at angles ranging from 0° to 180°. The results were categorized as "Flexible" or "Not Flexible" based on the grass's ability to withstand bending stress. This study provided valuable insights into the material's mechanical properties, helping to determine its suitability for various applications, such as textiles, construction materials, or bio-based composites.

B. *Effectiveness Between The Malatarlak Yarn And Conventional Yarn As A Potential Material In Yarn In Terms Of Elongation*

1) *Observational Checklist of Malatarlak Yarn (Themeda Arundinacea) in terms of Elongation.*

The researchers test the elongation of malatarlak yarn and conventional yarn in various sizes or diameters. By subjecting the yarn to different kilograms of weight, they determined if the yarn is capable of elongating. To measure the elongation of a yarn, one can use a tensile testing to apply a controlled force and observe how much the yarn stretches before breaking (Kelvin, F., (2021). This research could provide valuable insights into the potential applications and properties of malatarlak yarn

TABLE 2: ELONGATION OF MALATARLAK YARN

Size	Elongation			Remarks	
	2kg	4kg	6kg	Elongate (20%-100%)	Not able to Elongate (1%-20%)
2.25mm	18	18.18	18.54		/ 18Pa-18,54Pa
3.25mm	19.98	23.04	21.06	/ 19.98Pa-23.04Pa	
4.25mm	28.08	28.98	30.06	/ 28.08Pa-30.06Pa	

Table 2 documented a study on the elongation of Malatarlak yarn under varying weights (2 kg, 4 kg, and 6 kg) and yarn diameters (2.25 mm, 3.25 mm, and 4.25 mm). The researchers sought to quantify the yarn's ability to stretch under different loads, informing potential applications. The table revealed that elongation increased with both applied weight and yarn diameter, indicating that larger diameter yarns exhibited greater stretchability under stress. The remarks column provided additional context: the 2.25 mm yarn showed elongation within a range where significant elongation was not observed (1%-20%), while the 3.25 mm yarn displayed elongation within the 18Pa-18.54Pa range, and the 4.25 mm yarn demonstrated elongation in the 28.08Pa-30.06Pa range. This data was crucial for understanding the yarn's elasticity and its suitability for applications demanding flexibility and resilience, such as textiles, ropes, or bio-based composites.

C. Effectiveness Of The Malatarlak Yarn Compared To The Conventional Yarn As To The Technique In Terms Of Knitting

1) Observational Checklist of Malatarlak Yarn (Themeda Arundinacea) Compared to the Conventional yarn as to the Technique in terms of Knitting

The Researcher tested the malatarlak yarn as to the techniques of Knitting by testing the malatarlak yarn in different stitch pattern and assessing its characteristics in terms of Texture and also different needle sizes that they will use. Yarn is deemed good for knitting if it can handle all types of stitches and is compatible with various fabrics (Crochet World, 2022).

Table 3: Knitting Of Malatarlak Yarn

Knitting Characteristics						Effectiveness	
Stitch Pattern	Knitt stitch (1)	Purl stitch (2)	Garter stitch (3)	Stockinette stitch (4)	Seed stitch (5)	Applicable (If the value 1-5 has been checked)	Not Applicable (If the value 1-5 has not been checked)
	/						/
Yarn type	Smooth (1)	Fuzzy (2)	Chainette (3)	Single Ply (4)	Multi ply (5)	Applicable (If the value 1-5 has been checked)	Not Applicable ((If the value 1-5 has not been checked)
					/		/
Needle Sizes	25.0mm	20.0mm	19.0mm	17.0mm	15.0mm	Applicable (If the value 1-5 has been checked)	Not Applicable ((If the value 1-5 has not been checked)
	/	/					/

Table 3 presented knitting characteristics for Malatarlak yarn, showing recommended needle sizes for different stitch patterns and yarn types. The table suggested a correlation between yarn type and needle size; smoother yarns required larger needles (25.0mm), while fuzzier yarns required smaller needles (20.0mm). The needle size decreased further for chainette, single ply, and multi-ply yarns (19.0mm, 17.0mm, and 15.0mm, respectively). The slashes ("/") indicated that certain stitch patterns might not have been suitable for all yarn types or that the data was unavailable. This aligned with general knitting knowledge where needle size was adjusted based on the yarn's weight and texture to achieve the desired stitch definition and fabric drape. Beyond textiles, innovative yarns drove significant advancements across various industries. Scientists utilized biomimicry (bionics) to design yarns with enhanced capabilities. The use of recycled materials and alternative natural fibers in yarn production fostered a more sustainable approach to clothing. Smart yarns were fundamental to the creation of high-performance fabrics (Keysi, 2020).

2) Likert Scale of Malatarlak Yarn (Themeda Arundinacea) Compared to the Conventional yarn as to the Technique in terms of Knitting

The Likert scale has been employed to assess the satisfaction of individuals involved in knitting. Through a series of carefully crafted questions, participants will have the opportunity to provide feedback and rate their feelings and experiences related to knitting. This will allow us to gain valuable insights into their levels of satisfaction in this creative activity.

TABLE 3.1: The Summary of the Tables of Conventional Yarn for Knitting Techniques

Statements	Weighted Mean	Verbal Interpretation
1. I am satisfied with the performance of Malatarlak yarn in terms of issues like splitting or shedding while knitting.	2.33	Dissatisfied
2. I am satisfied with the durability of Malatarlak yarn after completing your knitting project.	3.00	Neither/Nor Satisfied

3. I am satisfied with the idea of purchasing Malatarlak yarn for your future knitting projects	1.00	Very Dissatisfied
4. I am satisfied with the durability of Malatarlak yarn when used for knitting projects.	2.67	Neither/Nor Satisfied
5. I am satisfied with recommending Malatarlak yarn to other knitters or crafters.	1.67	Very Dissatisfied
Grand Mean:	2.13	Dissatisfied

Table 4 presented the satisfaction levels among respondents regarding the use of Malatarlak yarn in knitting. The durability of Malatarlak yarn after completing knitting projects received a weighted mean of 3.00, indicating a neutral stance with the verbal interpretation of "Nor Satisfied." Following this, the performance of Malatarlak yarn was rated as a mean of 2.33, which signified "Dissatisfied." The willingness to recommend Malatarlak yarn to others garnered a mean of 1.67, interpreted as "Very Dissatisfied." Additionally, the respondents expressed notably low satisfaction regarding their intention to purchase Malatarlak yarn for future projects, yielding a weighted mean of 1.00, which signified "Very Dissatisfied." The overall grand mean for satisfaction in knitting was 2.13, indicating a general dissatisfaction with Malatarlak yarn across all aspects. According to Smith (2018), consumer satisfaction heavily influenced product usage and preference, which may explain the negative responses towards Malatarlak yarn compared to conventional options, underscoring the urgent need for quality improvements to better meet user expectations.

IV. DISCUSSION

This study examined the flexibility, elongation, and knitting characteristics of Malatarlak Grass yarn, focusing on its potential applications in textiles. By analyzing its performance across different diameters and external conditions, the study provided insights into how the yarn behaved under bending, stretching, and knitting processes. Understanding these properties was essential in determining its suitability for various textile applications, particularly those requiring durability and user satisfaction.

Flexibility tests revealed that Malatarlak Grass yarn remained pliable across different diameters and bending angles, showing no signs of cracking or stiffness. This indicated its ability to withstand repeated bending without losing durability. This characteristic aligned with findings from Margaret (2020), who emphasized the importance of flexibility in textile materials, particularly for electronic textiles that required resistance to permanent deformation. Similarly, Doran and Sahin (2019) noted that yarn thickness and weight influenced flexibility, supporting the observation that Malatarlak yarn maintained consistent pliability across different diameters.

Elongation tests showed that both yarn diameter and applied weight significantly affected its stretchability. Larger diameter yarns exhibited greater elongation, allowing them to absorb more energy before failure. This characteristic made them ideal for applications requiring elasticity, such as rope manufacturing and elastic textiles. Research by Garcia and Lee (2020) confirmed that increased yarn diameter contributed to higher elongation percentages under load, while Chen (2018) highlighted elongation as a key factor in textile resilience. These findings suggested that Malatarlak Grass yarn had potential for applications where stretchability and energy absorption were crucial.

In knitting applications, Malatarlak yarn was tested across five stitch patterns—knit, purl, garter, stockinette, and seed stitch—using different yarn types and needle sizes. While the yarn exhibited breathability and moisture-wicking properties, its heaviness and inelasticity posed challenges, affecting the ease of knitting. Tonia (2020) highlighted similar issues with plant fibers, emphasizing their weight as a limiting factor in knitting performance. User satisfaction data further revealed concerns, particularly regarding splitting, shedding, and durability.

V. CONCLUSION

The study concluded that Malatarlak Grass yarn exhibited limitations in color output and texture, making it unsuitable for a wide range of applications. However, its flexibility made it useful for certain purposes.

While its elongation contributed to its potential uses, its tensile strength, elasticity, thickness and friction was not sufficient for yarn-making.

Its performance in knitting showed that it was suitable for these techniques. While in crocheting, weaving, and embroidery showed that it was not suitable for these techniques.

To improve the yarn's quality, future research should explore natural softening methods that enhance its texture without compromising its durability. Finding a balance between softness and strength is crucial to expanding its usability.

Researchers should also investigate dye compatibility to enhance the yarn's appearance by testing various natural and synthetic colorants that provide vibrant and long-lasting results.

Addressing the presence of bulges in Malatarlak fibers during processing is essential for improving tensile strength and expanding its potential applications. Since yarn did not perform well in traditional textile techniques, further research should focus on refining processing methods and identifying alternative uses such as macrame and fiber art, where its unique texture could be an advantage.

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VII. LIMITATIONS

This study focused on the Municipality of Capas, Tarlac, specifically exploring the potential of Malatarlak grass as a material for yarn production. The research centered on the process of turning pure Malatarlak grass into yarn without the use of any chemicals. The study highlighted the physical and mechanical properties of Malatarlak grass yarn, as well as its dyeability for color variations. It did not encompass the cultivation or harvesting of Malatarlak grass, as the focus was solely on its use in yarn making. Chemicals were not utilized in the production of Malatarlak grass yarn to emphasize its sustainability and natural properties. The research did not delve into the marketability or economic aspects of Malatarlak grass yarn production but solely concentrated on the characteristics and properties of the yarn.

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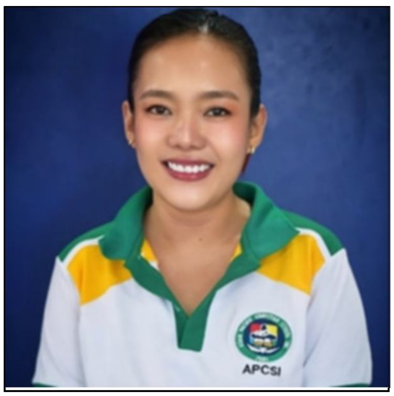

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