From Waste to Cloth: Sustainable Textile Innovation in Uganda

Mary Ruppert-Stroescu, Joyce Nabisaalu Komakech
Oklahoma State University, USA

Keywords: Textile, fiber, sustainability, bannana

Introduction

Economic empowerment in Africa is most sustainable when developing indigenous skills and resources (Eyong, 2007). In Uganda, the banana is one of the most important food crops, grown by about 75% of the farmers and feeding over 12 million people (UBOS, 2014). A species of the banana, the Pisang Awak, is a 3-meter tall plant producing staple food in the central and western regions of Uganda. Most of the plant's layered pseudstems contain fibers, yet are commonly left in the field as waste (FramAfripedia, 2011). Bast fiber extraction is a common practice for flax however there is a gap in scientific research regarding the extraction and transformation of bast fibers from banana pseudostems into textiles (Mukhopadhyay, Fangueiro, Arpac, & Şentürk, 2008). Thus, the purpose of this study was to demonstrate the potential of fibers from Pisang Awak pseudostems for sustainable textile production with the eventual goal of enhancing economic development in Uganda by providing the rural poor another source of income: fibers derived from agricultural waste.

Method

The pseudostems of the organically-grown Pisang Awak were harvested and the fibers were extracted, spun, and woven into fabric. Employing a method commonly used for paper production, one hundred twenty raw Pisang Awak pseudo stems about 50" long and 5" in diameter were cut from the field using a machete and transported to the processing plant where extraction yielded approximately 10 kilograms of unprocessed fibers. The pseudostem's multiple layers of fibers, tightly packed together (Figure 1), were manually separated, inserted into the extraction machine (Figure 2), and hung to dry for twenty-four hours. To improve the fiber hand, weaving

Figure 1: Pseudostems

Figure 2: Machine extraction

Figure 3: Woven fabric

and bending properties, the fibers were softened by boiling them in water with a Sodium hydroxide (NaOH) and soda ash solution; the chemicals were disposed of in an environmentally safe manner. The softened fibers were combed to improve their alignment and spun by hand with an average twist of about 8 turns per inch. Two yarns were plied together for the warp to strengthen the single yarns. The warp yarn was loaded on a loom to weave fabric 30 cm wide; two meters of plain weave fabric were produced (Figure 3).

Results, Conclusions, and Future Study

This pilot study, performed in Uganda, demonstrated that the concept of transforming the Pisang Awak pseudostems into fibers and textiles is viable. The finished fabric was cream colored, smooth, flexible, and resilient. The methods employed promote sustainability of the process and the product, using organically grown pseudostems that would otherwise have been considered waste while requiring only machines, materials and skills already existing in Uganda.

Analysis of the process revealed a need for future study to refine the extraction process, the use and disposal of chemicals for softening, as well as fiber spinning and finishing. The extraction machine used was designed for the paper making process; in order to reduce fiber waste and breakage, manual extraction and more refined machines should be tested. In addition, when separating the pseudostem's multiple layers, the drying time before extraction influenced the fiber color; the longer the pseudostem's layers were exposed to sunshine causing water evaporation, the more the color changed from cream to brown. In addition, further experimentation with softeners is recommended, including enzymes, to continue fiber refinement and environmentally friendly practices. Spinning with sizing in the fibers may improve cohesiveness; cutting the long fibers into staple size and spinning may also improve yarn strength. Testing of finishing methods such as dyeing and printing would also provide more insight into ways to enhance the fabric's serviceability characteristics as well.

Once further research unveils standardized processing methods for transforming banana fibers in to fabric, production can then be conducted on a large scale. With involvement of rural poor farmers to extract fibers from the previously wasted banana pseudostems that they can sell for an extra income, banana fiber production represents a significant potential for sustainable economic development in Uganda at many levels, from helping individuals to contributing to to contributing to Uganda's gross domestic product (GDP).

References

Eyong, C. T. (2007). Indigenous knowledge and sustainable development in Africa: Case study on Central Africa. Indigenous knowledge systems and development: Relevance for Africa, 121-139.

FramAfripedia (2011), Retrieved from http://farmafripedia.ikmemergent.net/index.php/Bananas

Mukhopadhyay, S., Fangueiro, R., Arpac, Y., & Şentürk, Ü. (2008). Banana fibers–variability and fracture behaviour. Cellulose, 31(3.61).

Uganda Bureau of Statistics (UBOS) 2016, The National Population and Housing Census 2014 – Main Report, Kampala, Uganda, 53-54.