BUSITEMA UNIVERSITY
*Pursuing Excellence*

FACULTY OF ENGINEERING

TEXTILE AND GINNING ENGINEERING DAPARTMENT

# THE SUITABILITY OF UGANDAN MUSA SAPIENTUM BANANA PLANT SPECIES FOR TEXTILE FIBRE PRODUCTION



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## DECLARATION

I **Damari Kashemere** do declare to the best of my knowledge that I did this Final Year Project in partial fulfillment of the requirements for the award of a Bachelor of Science in Textile Engineering of Busitema University and that the work here is solely of my own effort, except where reference has been appended. It is in no case a reproduction of any other work.

..... ..... 28th MAY 2013 .....

Signature Date

# APPROVAL

This report has been submitted for examination with approval from the following supervisors:

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Last but not least, a special cheer for all my fellow students for their enthusiasm, love and encouragement

I wish you success in the struggle to liberate your selves from ignorance, poverty and disease, and may the good Lord richly reward you with success.

# DEDICATION

I dedicate this report to my dear Dad and Mum whose sacrifice has seen me into the world of engineering.

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# ACRONYMS

| | |
|---|---|
| Ha | hectare(s) |
| Kg | kilogram(s) |
| FAO | Food and Agriculture Organization of the United Nations |
| ASTM | American Society for Testing and Materials |
| w/v | weight on volume |
| w/w | weight on weight |
| SEM | scanning electron microscopy |
| GPL | grams per litre |
| Sd | standard deviation |
| SE | standard error |
| $C_v$ | Coefficient of variation |
| OH | Hydroxyl |
| COOH | Carboxyl |

# ABSTRACT

Banana stem has no use after harvesting the fruit; there is a huge generation of waste as a consequence of the plant life-cycle, because pseudostems, hangers and leaves are not economically used. Therefore this study was carried out to analyse the suitability of Ugandan *Musa Sapientum* banana species for the production of textile fibre. The fibre was extracted from the banana pseudostem by hand, morphological characterization of fibres was done, the fibre was scoured using an alkali (NaOH and ash water) and then bleached using hydrogen peroxide. Scouring was done at different NaOH concentrations and ash water at different timings of 30, 60 and 90minutes respectively. Fibre tensile property testing was done before and after fibre treatment. The fibre morphological properties were analysed before any fibre treatment was done.

Generally Musa Sapientum was found to have very robust fibres that could be used in various textile applications as industrial textiles, consumer textiles, furnishing textiles among others.

Musa Sapientum fibre treatment using alkali increases its tensile strength and young's modulus and has got less effect on fibre elongation. . Morphological characterisation showed that treated fibres' surface was rougher than that of untreated fibres.

From the results, the optimum scouring conditions for Musa Sapientum fibre scouring is using 2g/L of NaOH or ash water of PH 10 for one hour; however ash water treatment gives stronger fibres with higher modulus of elasticity. High figure of young's modulus signifies fibre stiffness.



Key words; Musa Sapientum fibre, optimisation, mechanical and physical properties, textile application

# CHAPTER ONE: INTRODUCTION

## 1.1 Background

Bananas occupy the largest cultivated area among staple food crops in Uganda and are primarily grown on small subsistence farms (plots of less than 0.5 ha). In general, the Great Lakes region covering parts of Uganda, Rwanda, Burundi, Tanzania, Kenya and DRC is the largest producer and consumer of bananas in Africa (Smale, 2006) where per capita consumption has been estimated at more than 250kg; the highest in the world (FAO, 1985). Specifically, Uganda ranks second after India in the world banana production with an annual output of 9.84 million tones accounting for 11.18% of the world's total production (INIBAP, 1999). The area under banana production is 1.3 million hectares and this constitutes 75% of arable land (NARO, 2000).

In recent years, the search for alternative sources of fibers has been increasing due to the continuous reduction of cotton yields, the main textile fibre in Uganda and other countries. There have been many solutions to this problem; like substitution with the manmade fibres, extraction from other natural fiber producing plants which has tried to overcome the shortage. Synthetic fibres/manmade fibres have proved to take up the biggest percentage in the problem solving (see figure 2), however these fibres are not eco-friendly because of their non-biodegradable nature which has raised much environmental concern. More so these synthetics are not recyclable and their manufacturing process is not an easy venture due to the large quantum of energy needed during their production process (for example; figure 1)

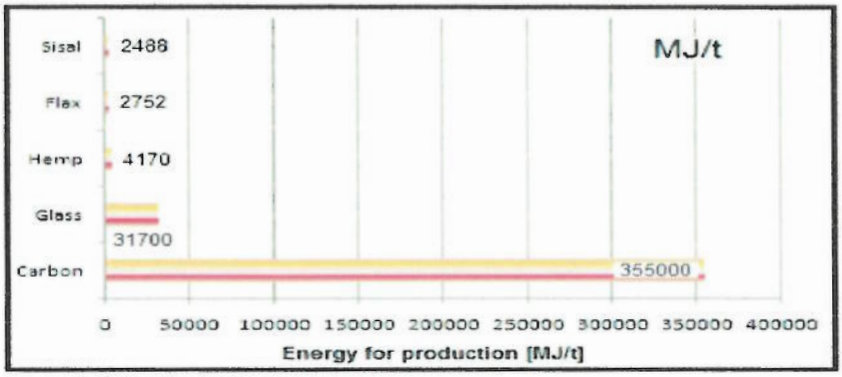


**Figure 1: Energy for production of some of the natural fibres and carbon fibre (Sources: SachsenLeinen; Daimler 1999; BAFA;NOVA; AVB; CELC; REO)**

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