

**BUSITEMA  
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**FACULTY OF ENGINEERING**

**DEPARTMENT OF TEXTILE AND GINNING  
ENGINEERING**

**INVESTIGATING THE EFFECT OF REELING SILK FILAMENTS  
DIRECTELY (ON A HAND OPERATED RE-REELING MACHINE)**

**BY**

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*The project report submitted to the department of ginning and textile engineering as a requirement to the partial fulfillment to the a ward of a Bachelor of Science degree in Textile engineering of Busitema University*

*May 2014*



## DECLARATION

I Ronad Angarukamu, registration number BU/UG/2010/116 declare that the information contained in this report is in accordance to the findings of the research that I personally undertook as per the requirements of the project proposal that I personally undertook and has never been submitted by any person for an academic or any other award.

..... 05/06/2014 Ronad Angarukamu

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Date..... 05/06/2010

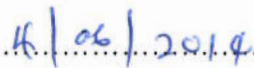
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## APPROVAL

This project report has been presented to the following officials for approval.

Main supervisor: MADAM CATHERINE NAMUGA

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Date.....

Co-Supervisor: MR. EDWIN KAMALHA

Signature.....

Date.....

## ACKNOWLEDGEMENT

First of all, I thank the almighty God for the gift of life and for the knowledge and courage that has enabled me complete my research project successfully.

Special thanks go to my supervisors, Mrs. Catherine Namuga and Mr. Edwin Kamalha for their tireless expert guidance, continuous advice, and encouragement offered to me throughout the whole process of preparation of the research proposal and in carrying out the research.

Thanks also go to Busitema University Textile and Ginning Engineering department, not forgetting Eng. Rwawire Samson - the head of the department and Engineer Wandera W Johnnie-Team leader MSI for all the guidance and Ideas rendered to us ever since we joined Busitema University.

In a special way, I thank the staff at National Sericulture Center- Kawanda for the support they rendered to me both technical and facilities during research proposal and during my investigations. The Senior Entomologist Madam Asaba Christine, Mr. Ssempe-The Senior Technician, Rachael and Hope , surely God Bless You.

Lastly, I thank, all my friends for the ideas shared and all kinds of support rendered during identification of the project topic and during the preparation of the Research proposal and project report.

## DEDICATION

I dedicate this report to my Parents Mr. Elisha Bamuhwaho and Mrs. Enid Kyarisiima, Brothers and sisters and to all my friends who have been there for me.

"It's been climbing on the giant's shoulders that I am here" You are the Real Giants!

*"New systems establish themselves, not by wholesale rejection of the old, but by gradual, sequenced, piecemeal replacements of the old. - This ensures continuity and stability in systems."*

## ABBREVIATIONS

NARO	National Agricultural Research Organization
NARL	National Agricultural Research Laboratories
USIL	Uganda Silk Industries Limited
ICIPE-	International center of Insect Physiology and Ecology
UBOS	Uganda Bureau of Statistics
GDP	Gross Domestic Product
JAICAF	Japan Association for International Collaboration of Agriculture and Forestry
BLG	Bushenyi Local Government
NYTIL	Nyanza Textile industries Limited
NSC	National Sericulture Center
FAO	Food and Agricultural Organization
AP	Andhra Pradesh

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## ABSTRACT

The research project investigated the effect of reeling silk filaments directly on a hand operated re-reeling machine. The objectives of the investigation were;

1. To spin silk filaments directly on the re-reeling machine.
2. To test and determine the mechanical and physical properties of yarn obtained from directly wound filaments/yarns and those of the yarn obtained by indirect reeling.
3. To determine the reelability ratio and compare the results with those obtained when using indirect reeling and make conclusions and recommendation(s).
4. To establish a cost benefit analysis of direct reeling on a hand operated re-reeling machines

Results were obtained by carrying out reeling experiments from the National Center Kawanda (NSC), using Bombyx Mori cocoons and the silk skeins obtained were tested of their properties. Comparison of the direct and indirect reeling techniques was based on the ease of performing each experiment and also comparing the samples' properties that were obtained through performing both visual and mechanical tests on them. The collected data was arranged into tables, graphs and then interpreted.

The investigation revealed that;

It is possible to reel directly on hand operated re-reeling machines. The reelability ratio, reeling efficiency were almost the same as done on the machines. Many properties of silk produced directly were almost comparable with those of the silk produce indirectly such as specific gravity and colour. The size deviation was minimal, elongation and strength almost equal. Direct reeled skeins gave higher yarn count than the ones produced indirectly. The cost effectiveness of direct reeling was better than that of indirect reeling.

In General, It is possible to do direct reeling on a hand reeling machine and obtain good quality thread if more study is carried out.

The research recommended that more reeling research needs to be done at Uganda's silk research institute so that new effective and affordable reeling techniques are brought in. This will improve local innovation and in the long run on Uganda's effort to compete favorably with other silk producing countries.

## CHAPTER ONE: INTRODUCTION

### 1.1 Background

Uganda's textile industry is mainly dominated by synthetic fiber products. Most of these products are made of polyester, viscose, nylon etc. Natural fibers especially cotton have also been competing with synthetics though not favorably. Other natural fiber products on the local market are made from vegetable fibers which include sisal, jute, flax, banana etc. and protein fibers which include wool and silk. Most of these natural fibers are locally produced though on small scale due to a number of challenges such as inefficient machines, inadequate research, competition from synthetics and high labour and capital requirements.

Efforts to promote rural income generation and export diversification in Uganda have led to the development of sericulture. This is a new economic activity which is also partly industrial (*John Ndyabagye*). The world raw silk production had reached 125605 tons by the end of fiscal year 2004 (Government of AP, Global silk scenario, 2013).

In Uganda, silk research is championed by National Sericulture Center and Bushenyi district is the leading district in the production of silk. Other main silk producing districts include Kanungu, Mbarara, Kamuli, Mukono, and Iganga. The data below is an indication that a lot of effort is needed to bring many farmers on board in order to create a steady supply and thus a reliable market.

**Table: 1 Silk farmer's statistics in Bushenyi district, south western Uganda**

Variable	Quantity
Estimated number of silk farmers	350
Number of active farmers	160
Silk factories in the district	1
Hatcheries	1
Silk development centres	3
Production in 2004	16 tones

*Adopted from Entomology office B.L.G, 2010*

Abdul Bari (2000). Certain qualitative studies on Tasar Cocoons. PhD Thesis submitted to Kakatiya University ; Warangal, Andhra Pradesh, India.

[www.ugandainvest.go.ug](http://www.ugandainvest.go.ug), Accessed on 8<sup>th</sup> Sep, 2013

<http://www.fao.org/docrep/006/ad095e/AD095E01.htm>, Retrieved on 3<sup>rd</sup> Oct, 2013

[www.indiansilk.kar.nic.in](http://www.indiansilk.kar.nic.in), Accessed on 29<sup>th</sup> Nov, 2013

[www.fao.org/docrep/x2099e/x2099e11.htm](http://www.fao.org/docrep/x2099e/x2099e11.htm), Retrieved on 3<sup>rd</sup> Oct, 2013

[www.karunadu.gov.in](http://www.karunadu.gov.in), Accessed on 10<sup>th</sup> Dec, 2013

[www.seri.ap.gov.in](http://www.seri.ap.gov.in), Accessed on 10<sup>th</sup> Dec, 2013

State institute of Vocational Education, A.P. (2006) "*Curriculum of Intermediate Vocational course in sericulture*"