



**BUSITEMA
UNIVERSITY**
Pursuing Excellence

FACULTY OF ENGINEERING
**DEPARTMENT OF AGRICULTURAL MECHANIZATION
AND IRRIGATION ENGINEERING**

DESIGN AND FABRICATION OF A COFFEE HULLING MACHINE

BY

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Abstract

Coffee is one of the most important cash crops grown across the world and a major source of export earnings. Coffee hulling is the removal of what is left of the fruit from the bean, whether it is the crumbly parchment skin of wet-processed coffee, the parchment skin and dried mucilage of semi-dry-processed coffee, or the entire dry, leathery fruit covering of the dry-processed coffee.

The simplest traditional methods of hulling parchment coffee (seeds) involve the use of pestle and mortar and a sack and pestle. However, these methods are of low hulling and cleaning efficiency, cause over breakage of the coffee beans and are also labor intensive

The purpose of this project was to design and construct a coffee hulling machine for helping coffee farmers improve on the quality of their coffee beans through reducing breakages which yield high market prices hence improving their economic wellbeing

The method of primary processing of coffee is a vital determinant of quality and price. Wet processing method produces higher quality beans but is very laborious. A motorized coffee hulling machine was designed, fabricated and tested to assist coffee farmers to hull coffee easily and cheaply. The hulling machine consist of a hopper, hulling drum, a blowing fan, cleaning unit, belts and pulleys, a reciprocating screen, a shaft, Power source, Outlet for hulled coffee beans and coffee husks and the frame. The design philosophy is to use rubber beaters to achieve sufficient impact force that can break the hull of green parchment coffee and detach the beans through impact and shearing forces caused by rubber beaters. The beaters arranged around the circumference of a hollow pipe rotate with relatively high speed to achieve sufficient impact force and also move the broken materials against the concave to release the beans from the hulls. The performance tests carried out on the constructed machine showed an efficiency of 90% with an output capacity of 120kg/hr. This machine can be produced in local small machine shops existing in coffee producing areas in Uganda.

DECLARATION

I NIMUSIIMA PELTH declare to the best of my knowledge that this project report is as a result of my research and effort and it has never been presented or submitted to any institution or university for an academic award.

DATE

SIGNATURE

APPROVAL

This final project report was compiled and submitted to the Department of Agricultural Mechanization and Irrigation Engineering under the supervision of;

Main Supervisor

Mr. IGGA HUZAIRU

Signature

Date.....

Co-Supervisor

Mr. ERIAU EMMANUEL

Signature

Date.....

DEDICATION

This report is dedicated to my beloved parents Mr. Bagambe Godfrey & Mrs. Christine Atukwasibwe Bagambe in appreciation for their selfless care and unflinching support provided to me since childhood, and for the spirit of hard work, courage and determination instilled into me, which attributes I have cherished with firmness and which have indeed made me what I am today.

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First and foremost, I would like to thank the ALMIGHTY GOD for my life and good health I am living today. Thank you Father and may your name be glorified.

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Lastly, I warmly thank all my friends and course mates for all their support and assistance that has been a positive contribution to the success for this report.

ACRONYMS

WCPT Wet Coffee Post harvest handling Technology

DCPT Dry Coffee Post harvest handling Technology

UCDA Uganda Coffee Development Authority

PEAP Poverty Eradication Action Plan

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CHAPTER ONE: INTRODUCTION

1.0 Introduction

1.1 Background

Coffee is one of the most important cash crops grown across the world and a major source of export earnings. Coffee (Rubiacea) consists of more than one hundred species such as *Coffea Arabica* L and *Coffea canephora* P which are commonly grown (Rick and Graham, 2004). *Coffea Arabica* L. is most grown variety and represents three quarters of the world coffee productions whereas *Coffea canephora* P. makes up one quarter of world coffee production (Kristina, 2011). In Uganda, the most commonly grown species are Robusta and Arabica in the ratio of 4:1 respectively. Robusta is grown in the low altitude areas of Central, Eastern, Western and South Eastern Uganda up to 1,200M above sea level while Arabica coffee is grown on the slopes of Mount Elgon in the East, Mt. Rwenzori and Mt. Muhabura in the South Western Region (1500-2,300m above sea level). Uganda's best known Arabica coffee is grown on the slopes of Mt. Elgon in eastern Uganda.

Coffee is an important cash crop that supports over 3.5 million families at all levels of the value chain contributing to income security and between 20 - 30% of Uganda's foreign exchange earnings (UCDA, 2012). Coffee is therefore extremely important to both rural population and Ugandan economy as it provides an estimated 500,000 coffee-growing small house holding with their main source of income and they produce 97% of the country's crop.

The Coffee processing technologies used in Uganda are dry and wet. Wet processing involves cherry separation, washing and hulling. The mucilage layer is removed by bio-chemical enzyme activity through controlled fermentation. The major challenges faced by Ugandan small scale coffee growers at processing level include, deterioration of the quality of parchment, increased contamination risks and high breakages of coffee beans due to traditional hulling methods for instance pounding coffee in a mortar (Gitonga, 2004). All the above results into qualitative and quantitative losses leading to low income earning from the coffee sales and thus low standards of living. Additionally coffee production declines and thus low income to the Uganda's economy. Under Poverty Eradication Action plan (PEAP, 2004), Uganda is encouraging its farmers to improve the quality of their coffee if they are to obtain competitive prices for their product on the world market. In effort to improve the quality and the income generated from coffee, Wet Coffee

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