BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF AGRO PROCESSING ENGINEERING

DESIGN AND FABRICATION OF A PEDAL OPERATED CASSAVA CHIPPER FOR SMALL SCALE CASSAVA GROWERS

BY

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A final year project report submitted in partial fulfilment of the requirements for the award of the degree of Bachelors of Science in Agro Processing Engineering at Busitema University

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DECLARATION

I NEMWA IRENE declare to the best of my knowledge that the piece of this report is 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 28/06/2014.....

SIGNATURE .....

APPROVAL

This project report has been submitted for examination with approval from the followingsupervisors;

MAIN SUPERVISOR; Mr KAVUMA CHRIS

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May the ALMIGHTY GOD bless you abundantly!

LIST OF ACRONYMS

CBSD	–	Cassava Break Streak Virus Disease
CMD	–	Cassava Mosaic Virus Disease
CMGs	–	Cassava Mosaic Geminviruses
EARRNET	-	East Africa Root Crop Research NetworkGTZ - Deutsche Gesellschaft Fr Technische Zusammenarbeit GmbH
ha	–	hectares
HQCF	–	High Quality Cassava Flour
IITA	–	The International Institute of Tropical Agriculture
m.s	–	mild steel
MAAIF	–	Ministry Of Agriculture, Animal Industry and Fisheries
MD	–	Managing Director
NARL	–	National Agricultural Research Laboratories-Kawanda
NARO	–	National Agricultural Research Organization
PMA	-	Plan for Modernization of Agriculture
PPD	–	Post-Harvest Physiological Deterioration
UBOS	–	Uganda Bureau of Standards
USAID	–	United States Agency for International Development

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ABSTRACT

In Uganda, cassava plays a major role in food security contributing up to 60% of the basic food requirements nationally. It is mostly grown by small scale farmers cultivating about 1-3 acres of land. Cassavabeing highly perishable, it is urged to process it immediately after harvesting because physiological postharvest deterioration (PPD) starts within 48 to 72 hours after harvest. PPD turns the cassava tubers to brown or black which reduces the products' acceptance by the people who want purely white dry cassava hence lowering its market.Cassava processing involves peeling, chipping, drying, roasting, crisps and chips making and flour milling. In Uganda, these processes are majorly done using traditional methods and tools for example local knives, machetes, and stones. These methods produce large sized slices which still are subjected to PPD since they take long to dry. In addition, these traditional processing methods are tedious and also expose the operators to a high risk of injuries.

To reduce tediousness and drudgery, a pedal operated cassava chipper was developed for small scale cassava growers. This produces chips about 2 to 10mm thick which dry 6-8 hours. The pedal operated cassava chipper operates using a local bicycle mechanism which is familiar to the biggest percentage of the rural population hence it does not require any special training to be operated. Due to the fact that pedal power is greater than the power output by hand, the pedal operated cassava chipper has a higher output capacity than the hand operated chipper.

The development of pedal operated cassava chipper was achieved in the following steps/processes; design of the different components, selection appropriate materials for the components, fabrication and assembly of the prototype and finally testing of the prototype.

The prototype was tested for efficiency and capacity; the highest chipping efficiency of 95% was obtained at a speed of 40rpm while the highest machine capacity was 205kg/hr at a speed of 80rpm.Analysis of values showed that at high speeds, the capacity is high but low efficiency. The overall mean of the chipping efficiency was $90.27 \pm 4.75\%$ and machine capacity was $142.986 \pm 74.25 kg/hr$. The chipping efficiency and uniformity of chips were affected by the age, size, shape, orientation, feed rate and pressure of the tuber in contact with the chipping disc.

Keywords; Cassava, Chipping, Pedal Machine, Capacity, Efficiency

CHAPTER ONE: INTRODUCTION

Introduction

This section comprises of a brief overview on cassava, the processing techniques and the challenges attached to the techniques used. It also brings out the importance of cassava in the developing world. The objectives, purpose, scope and justification of the study

1.1 Background

Roots and tubers, most notably cassava, sweet potato, yam and potatoes (*Solanum*/Irish) are some of the most important primary crops. They play a critical role in the global food system, particularly in the developing world, where they rank among the top 10 food crops (Scott *et al* 2000, 1; Phillips *et al.*, 2004; Nweke, 2004). Cassava (*Manihot esculenta* Crantz) is a staple food in most tropical regions, and is grown over a range of climates and altitudes and on a wide variety of soils. Cassava is tolerant to drought; it is productive in poor soil where other staple crops cannot grow without intensive inputs (Leihner, 2002).

In 2003, 54% of cassava in the world was produced in Africa with Nigeria as the leading producer of cassava, 29 % in Asia and 14% in Latin America. About 3% annual production increase was recorded in Asia while 0.9% and 0.3% were recorded in Africa and Latin America respectively (FAOSTAT, 2004). In Africa, the continent with the largest cassava production (53% of world production of 230 million tons in 2010; FAO, 2012), about 93% of the production is used as food (Nweke*et al*, 2002).

In Uganda, cassava was introduced in 1860's and since then it has spread to most of the parts of the country where it plays a major role in food security especially in the eastern and northern regions where it is the staple food contributing up to 60% of the basic food requirements (Bua*et al*, 1991). Annual production of cassava in Uganda is estimated at 3.4 million tons from an area of 374,000 ha (FAOSTAT, 2000). It offers flexibility to resource-poor farmers because it serves as either a food security crop or a cash crop (FAO, 1995).

Cassava is highly perishable; PPD starts within 48 to 72 hours after harvest (Morante*et al.* 2010) and therefore it is advised to process the tubers immediately after harvest. However, cassava processing in Uganda is done but still at an infant stage as it involves peeling, chipping, drying, roasting, crisps and chips making and flour milling (Mbwika *et al*, 2001). These processes are majorly done using traditional methods and tools for example local knives, machetes, and stones

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