



**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*



**FACULTY OF ENGINEERING**

**DEPARTMENT OF CHEMICAL AND PROCESS  
ENGINEERING**

**AGRO-PROCESSING ENGINEERING PROGRAMME**

**FINAL YEAR PROJECT REPORT**

**Design and construction of a manually operated Sweet potato  
chipper.**

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## ABSTRACT

In Uganda, Sweet potato plays a major role in food security. It is grown as a subsistence crop and as a cash crop. About 44% of Ugandan farmers grow sweet potatoes. The major production area is the Eastern region and lowest in the semi-arid Northern region.

The harvesting and post-harvest activities of sweet potatoes have remained so labour-intensive that they are limiting production at the house hold level especially in the chipping of sweet potatoes, farmers still use the traditional method of hand-chipping. This method is time wasting, energy sapping and produces low output of chipped sweet potatoes, injuries and contamination due to prolonged handling by human hands.

To overcome this problem, this study chose as its main objective to design and construct a manually operated sweet potato chipper.

Various components of the sweet potato chipper were designed using basic engineering principles and some physical properties of sweet potato such as size, density, hardness, shear strength, moisture content, (70%), angle of repose, ( $37^{\circ}$ ) and weight of the tuber.

The machine was tested and the chipping rate was 82 kg/hr, with chipping efficiency of 84.2% for the pedal system and a chipping rate of 55 kg/hr, with efficiency of 71.6% for the crank lever system were obtained. The results were relatively high as compared to the traditional methods. The cost-benefit analysis of the prototype was carried out and payback period was calculated and obtained as 66 days.

## DECLARATION

I, **JAMES MENYA**, hereby declare that, this final year project report is a true work of my hands and that it has never been presented by any person to any institution for an academic award.

Signature: .....  .....

Date: 20/05/2015 .....



## APPROVAL

This final year project report for the programme of Agro-Processing Engineering has been submitted to the Department of Chemical and Process Engineering for examination with approval from my supervisors:

Mr. EDWARD SSEMUKASA

Signature:  .....

Date:  .....

Ms. JACQUELINE ABBO

Signature: .....

Date: .....

## DEDICATION

This report is dedicated to my beloved mother Mrs Sarah Kakaire, my brothers and sisters 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 in me, which attributes have made me what I am today.

## ACKNOWLEDGEMENTS

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## LIST OF ACRONYMS

### Acronym/Abbreviation

- 1) MAAIF – Ministry of Agriculture Animal Industry and Fisheries.
- 2) Kg – Kilogram.
- 3) g – Grams.
- 4) Kcal. – Kilocalories.
- 5) Mg – milligrams.
- 6) AEATRC – Agricultural Engineering and Appropriate Technology Research Centre.
- 7) CAD – Computer Aided Design.
- 8) FAO – Food and Agricultural Organisation.

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background of the study

Sweet potato (*Ipomoea batatas* L.) is an important food crop in Uganda, where it plays a major role in the food security system of the country (Bashaasha *et al.*, 1995). Sweet potato is among the world's most important, versatile and under-exploited food crop. Sweet potato currently ranks as the fifth most important food crop on a fresh-weight basis in developing countries after rice, wheat, maize, and cassava (Scott and Maldonado, 1999; Grant, 2003). In north eastern Uganda, sweet potato becomes a seasonal staple during the dry season when supplies of most other food stuffs are exhausted (Hall *et al.*, 1998).

Sweet potatoes are grown in most parts of Uganda. The major production is concentrated in areas of Mbale, Kumi, Soroti and Busoga. In Uganda, sweet potato is grown as a subsistence crop (food security) and as a cash crop (Ewell and Mutuura, 1994; Scott *et al.*, 1999; Abidin, 2004). During large harvests, farmers often sell potatoes at very low prices. Losses after harvesting are high because fresh sweet potato has a low shelf life due to its high moisture content. In some communities in Uganda, sweet potatoes are preserved for the dry season by sun-drying to make dried sweet potato chips ('*amukeke*').

The methods normally used in potato chipping include mechanical which involves use of both motorized and manually operated chipping machines, and hand chipping using knives. Moreover, sweet potato chipping using hand knives is not efficient in that it is time wasting, always associated with injuries (cuts), fatigue during chipping of a large consignments of sweet potatoes and yields a small output. The use of hand knives is also associated with contamination of the chips due to prolonged handling by humans.

Some of the existing chippers include the table mini chipper (hand operated), Arceden chipper (manually operated but can be upgraded to use an engine or electric motor), and Doala age chipping machine consisting of one or two concentric drums connected below

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