BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION ENGINEERING

DESIGN AND FABRICATION OF AN ANIMAL DRAWN ONION HARVESTER

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BU/UG/2012/15

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A final year project Report submitted to the department of Agricultural Mechanization and Irrigation Engineering as a partial fulfillment of the requirements for the award of a Bachelor's Degree of Agricultural Mechanization and Irrigation Engineering.

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ABSTRACT

Manual harvesting of onions is the commonly practiced method of harvesting in Uganda. This is rigorous and time consuming. It is associated with back pain and hurting of fingers. This work is dominantly done by women and children. The method does not cope up with large scale and hence the need to design and fabricate an animal drawn onion harvester.

This report is structured in five chapters to well report the introduction to the study, literature review, methodologies and methods followed during the design, results obtained after testing the prototype, and recommendations and conclusions.

This report contains methods that were used to design each component of the fabricated onion harvester, their dimensions and how their respective material of made were selected. The report also presents methods of fabrication that were used to come up with the harvester.

This report also includes field results obtained during testing of the machine. The designed and fabricated animal drawn onion harvester has a digging rate of 11.82kg per minute and harvesting efficiency of 85.97% with a pay-back period of 1.5years.

The topic under study was limited to designing of the animal drawn onion harvester and fabrication of the prototype. This machine is limited to areas that grow red grail variety of onions and soils that are light. It is also limited to areas that use animal traction. The study also covered testing of the efficiency of the animal drawn onion harvester.

The purpose of the study was to design and fabricate an animal drawn onion harvester aimed at reducing drudgery during harvesting onions, time wasting and compromising on the quality of onions. Furthermore to reduce on costs incurred in labour.

At the end of the study, the cost for employing a labor force during harvesting of onions was reduced by using an animal drawn onion harvester for digging and lifting onions off the ground to a collecting unit. The work which was meant to be done manually by many people ended up being done by few people which took a shorter period. Improving onion harvesting by using an animal drawn onion harvester is also expected to increase onion production in Uganda and this will improve many standards of living of people and income.

DEDICATION

I dedicate this project report to my parents so as to encourage other parents in my clan to take education of girl children serious, and to my sisters that they too can make it once they work hard.

ACKNOWLEDGEMENTS

I want to thank God for enabling me go through the four years of the course successfully. I thank God for all the guidance and provision throughout the course. I thank God for the idea of coming up with this project which he saw it come to completion. I am so grateful Lord.

I also want to express my sincere gratitude to my parents for the love, care, support and provision throughout the course. For even when things seemed not to be moving on well as they expected, they remained there for me. Thank you dad and mum. May God bless you abundantly.

I express my appreciation to my supervisors Mr. Dumba and Mr. Otim for the guidance and advice during the design and fabrication of this machine. I also thank Mr. Eriau, Dr. Catherine, Mr. Sserumaga, and Mr. Ebic for all their assistance.

I also thank my friends Suuna, Grace, my course mates and all those who contributed to the completion of my course in Busitema. May God reward you abundantly.

DECLARATION

I, NABUSHUWU JOY to the best of my knowledge and with a sound mind do declare that this project report consists of my personal work obtained from the research and literature review done. All the information therein has not been copied from any other person's work and where such has happened all the sources have been cited.

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APPROVAL

This project report is submitted in to the department of Agricultural Mechanization and Irrigation Engineering, faculty of Engineering, Busitema University as a partial fulfillment of the requirements for the award of a Bachelor's Degree in Agricultural Mechanization and Irrigation Engineering by the approval of:

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.....	And	.....
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LIST OF ACRONYMS/ABBREVIATIONS

C	Soil Cohesion
Kb	Cutting resistance
φ	Internal frictional angle
b	Cutting breadth
Lo	Original length
μ	Coefficient of friction
δ	Angle of soil-metal friction
W	Weight
A	Cross-sectional area
m	Mass
ρ	Density
F	Force
Kg	Kilogram
g	Acceleration due to gravity
Tab	Table
Fig	Figure
R	Reaction force
M	Bending moments
C	Carbon
N_2	Nitrogen

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CHAPTER I: INTRODUCTION

1. INTRODUCTION

This chapter provides an introduction to the study by presenting back ground of the study, the problem statement, and justification of the study, objectives and scope of the study.

1.1 BACKGROUND OF THE STUDY

Onions (*Allium cepa* L.) are one of the important commercial bulbous vegetable crops grown in different parts of the world; particularly the varieties that are grown are for bulb. In terms of global weight of vegetables produced, onions rank at nearly 28 million tons per annum, only tomatoes and cabbages exceed bulb onions in importance (Danilo, 2003)

Onions (*Allium cepa L.)* are one of the important commercial bulbous vegetable crops grown in different parts of the world. India ranks the first in the world with over 0.8ha of its total land area under onion production (Danilo, 2003)

Onions are grown mainly as food materials. They are highly valued for their flavor and for their nutritional value in supplying minor constituents such as minerals and trace elements. The bulbs are boiled and used in soups and stews, fried or eaten raw. They are also preserved in the form of jams. Onion leaves, especially the Spring onion, are also used in salads and soup. There is a lack of information on secondary and derived onion products (Platt, 1962).

Uganda grows Red grail onion variety (Red star F_1) mostly. It is preferred because it matures in three and half to four months, very uniform in growth with big and medium bulbs, very pungent with firm and very compact flesh, bulbs are deep and shiny red colour with closely sealed neck that prevents weight loss hence ensuring good keeping quality. Their yield is up to 25 tons/acre and have a seed rate of 1-1.2kg/acre (FAO, 2000).

Manual harvesting is the most common practice in Uganda. This is done by pulling the tops by hand. This method is rigorous and requires huge amount of man power and time. Workers hurt their fingers and suffer a lot of back pain. The work is dominated by women and children.

In developed countries, especially in large scale farms, mechanical harvesting is commonly used. The available machine for harvesting onions is a combine harvester tractor driven that digs, lifts,

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