BUSITEMA UNIVERSITY

Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION ENGINEERING

DESIGN AND CONSTRUCTION OF AN IMPROVED METAL SILO FOR MAIZE

BY

BWAMBALE JOASH

Reg. No.: BU/UG/2012/5

Email: jobwa23coltd@gmail.com

Mobile: +256 (0) 778212050

Supervisors: Dr. Wilson Musinguzi Babu

Mr. Okiria Martin

A final year project report submitted in partial fulfillment of the requirements for the award of a Bachelor of Agricultural Mechanization and Irrigation Engineering Degree of Busitema University

May 2016

ABSTRACT

In East Africa, Maize (*Zea mays* L) is a major staple food for a large proportion of the population. Its production has increased over the years as population increases and also as people change their consumption habits. Maize has a lager quantity of carbohydrates and significant proportions of proteins, vitamins fats contained in the kernels. This makes it compete favourably as an energy source with root and tuber crops. Maize in Uganda is sold mainly for food in schools, relief by World Food Programme (WFP) or export to neighboring countries such as Kenya, Rwanda and Burundi. However, farmers are unable to meet the ever increasing demand and compete favorably in the market due to grain storage losses. The traditional storage methods used like the granaries, jars, baskets, pots, floor storage, bags do not guarantee protection to maize against damage by pests, rodents and moulds.

Insect infestation normally commences in the field but most damage is done during storage. The maize weevil (*Sitophilus zeamais*) is one of the most serious pests of stored maize grain. The damaged grains have reduced nutritional values, low percentage germination, reduced weight and low market price. Some farmers use chemicals to control these pests but the chemicals have adverse effects on consumers. Besides, the farmers are unable to wait for the peak market demand due to fear of these losses thereby getting low incomes. This has also reduced on the food security in the region.

This project was focused on the design and construction of an improved metal silo for indoor storage of maize with the aim of reducing on the grain storage losses due to pests, rodents and moulds. It covered the necessary design considerations and the construction of a sealed silo for indoor storage of maize and the way of using it effectively for maximum results. It will also included testing of the efficiency of the silo in reducing storage losses as well as an economic evaluation of the structure.

Chapter three gives step by step procedure the researcher went through in order to design the sealed storage silo. The proposed design is to store a capacity of 200kg of maize grains.

DECLARATION

I declare that the information given in this report, to the best of my knowledge is original and has never been presented in any institution of learning for the award of any qualification of any form as authenticated by my Supervisors.

Name ..BWAMBALE JOSH.....Signature .....Date 28/5/2016

Supervisors

1. Name .....Signature ..... Date .....

2. Name .....Signature ..... Date .....

DEDICATION

I dedicate this report to my parents Mr. Mikira Jockus and Mrs. Christine Mikira and the whole family who whole heartedly supported me financially in the quest of my training. May the almighty God bless you.

ACKNOWLEDGEMENT.

I thank the Almighty God for His grace, love, wisdom, strength and protection in all aspects of my life.

I sincerely thank my sister Mrs. Kisembo Jesca and Brother Muhindo Boaz for their boundless support offered to me.

I am highly indebted to my project supervisors; Dr. Wilson Musinguzi Babu and Mr. Okiria Martin for their outstanding and valuable technical guidance and advice in execution of this project

I extend my gratitude to all Lecturers at the Faculty of Engineering most especially those in the Department of Agricultural Mechanization and Irrigation Engineering (AMI) for their valuable time for consultations in the development of this project report

Sincere appreciation goes to my course comrades and friends for their guidance and support

May the Almighty and everlasting God bless you abundantly.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER ONE

1.0 Introduction

This chapter comprises of the background, problem statement, purpose, justification, objectives, and scope of the study of the design and construction of an improved metal silo for small scale farmers.

1.1 Background of the study

Agriculture has been estimated for up to 60% of gross domestic product (GDP) in some Sub-Sahara African countries, employs over 70% of the population, 60 to 70% of consumption expenditure and 10 to 50% of foreign exchange earnings (IFC, 2010).

In Uganda, 75% of the poor people live in rural areas and mostly depend on agriculture for their daily livelihoods (Sonnino, 2010). Furthermore, Uganda's population is expected to increase from the current 35 million to about 47.3 million people by the year 2025. The challenges faced by small and medium scale farmers in Africa and other developing countries includes lack of good seedlings, lack of fertilizers, inadequate storage facilities, animals and insect pest.

On the other hand, post-harvest losses have been estimated up to 20 to 30% for staple food grains such as maize due to post harvest rodents, insect pests, inadequate grains storage practices and absence of storage management technologies. These problems often compel small farmers into selling their produce immediately after harvesting when prices are low, only to buy it back at an expensive price just a few months after harvest, thus causing them to fall in a poverty trap (FAO, 2009; Tefera et al., 2011). Consequently, farmers receive low market prices for any surplus grain they may produce.

The maize weevil (*Sitophilus zeamais*) known in the United States as the greater rice weevil, is one of the most serious cosmopolitan pests of stored cereal grain. Infestation by this weevil commences in the field but most damage is done during storage (Yuya et al., 2009). The damaged grains have reduced nutritional values, low percentage germination, reduced weight and low market price.

REFERENCES

FAO, n.d. Grain Storage Technics: Storage at farm or village level and in warehouses. Agriculture and consumer protection, [online].Available at: www.fao.org/docrep/TI838E/TI838E12.htm [Accessed 7 September 2015, 01:23AM]

Villers P., Navarro S., De Bruin T., (2008). Development of Hermetic Storage Technology in Sealed Flexible Storage Structures. Citation for Controlled Atmosphere and Fumigation (CAF) Conference in Chengdu, China, September, 2008, Session 9 (Achievements of CA and Fumigation, and development trends).

Khurmi R.S. and Gupta J.K., 2003 *Text book on Machine Design, 14th Edition,* EURASIA Publishing House (PVT) LTD

Carson, J.W and Jenkyn, R.T, 1993. Load Development and Structural Considerations in Silo Design.

Chase, George G., n.d. Solids notes 10. The University of Akron [Online]. Available at: http://www.inti.gob.ar/cirsoc/pdf/silos/SolidNotes10HopperDesign.pdf [Accessed 8 September 2015, 02:46 AM]

Md. Alauddin and Sohrabuddin A., 1995. Design forces and moments in circular silos based on finite element analysis. *Journal of the Civil engineering Division*, CE23 (1).

Nakashima, M. Ohomori, H. Kuramoto, H. Miura, K., 2010. Design recommendations for storage tanks and their supports with emphasis on seismic design. The Architectural institute of Japan.

The World Bank, 2011. Missing Food: The Case of Postharvest Grain Losses in Sub-Saharan Africa. Report No. 60371 -AFR, Washington, DC 20433.