BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF AGRO- PROCESSING ENGINEERING

DEVELOPMENT OF A MICROWAVE CONTINUOUS FLOW GRAIN DRYER

By

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Approval

This report has been submitted to the Department of Agro-Processing Engineering for examination with approval from the following supervisors:

Mr. Joseph Ddumba Lwanyaga

Date 6/06/2024

Signature.....

Mr. Jacob Etunganan

Date .....

Signature.....

ACKNOWLEGEMENT

This publication shows the development of an automatic microwave continuous airflow grain dryer as my final year project. The organization and publication of this report depended on the help of my supervisors and largely my effort.

I would like to extend my sincere appreciation to all those who assisted me, participated in or supported in the development of this project and the follow up of this publication, your assistance is gratefully acknowledged and may the almighty God bless you all!

Above all I thank God the giver of life for keeping me alive and well during this important time in my studies. I don't know what I would do without his grace and mercy upon me.

DEDICATION

I dedicate this report to my parents Mr. KALANGWA JOHN and Mrs. NAMAGAMBE DEBORAH KALANGWA plus my dear brothers and sisters, friends and all those who have offered me both educational and financial support as I developed this prototype most especially Mr. MAKUMBI PAUL, not failing to mention my supervisors Mr. JOSEPH DDUMBA LWANYAGA and Mr. ETUNGANAN JACOB for their guidance. May God bless you all!

DECLARATION

I **MULYAGONJA FRANCIS** do declare that all the work contained in this report is my own and has never been presented to any University or higher institution of learning for any academic award.

SIGNATURE.....

DATE.....4/06/2014.....

ABSTRACT

Maize (Zea Mays L.) was introduced in Uganda in 1861 and the estimated production is currently at 1.5 tonnes per hectare. In the Tropics, Grains are usually harvested when the moisture content is in the range of 25–33% which is too high for safe storage. This high moisture content sustains the bacterial and fungal activity, leads to growth of mycotoxins, insect infestation, putrefaction, algal growth and other factors that compromise the quality and quantity of the grain, thus, drying is a necessity.

More so, the functionality of the most common traditional method of drying i.e. sun drying depends largely on weather conditions. The World Bank in 2012 estimated that Uganda loses 5-15% of the maize produced during the drying stage due to generally poor drying methods.

This report therefore shows the various design procedures and methods for the construction of a microwave continuous flow grain dryer for off farm maize drying as a solution for the above mentioned problems; its performance and economic evaluation.

The dryer has an efficiency of 62.5% and an average percentage shrinking rate of 0.064 %/s. It is easy to operate and requires one operator. The machine cost was UG Shs 1,154,000 and has a payback period of 1.92 years which can be afforded by most of the targeted people.
This machine is adaptable and can be used in Uganda since it can be fabricated from any workshop using the available technology.

The design of the dyer is a simple one for easy cleaning, assembly and disassembly; and safe operation. Since the quality of dried maize was high, it can be packed and sold at a higher market value hence improving on the farmer's income. This machine can reduce on maize drying time and labour as compared to the traditional drying method.

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CHAPTER ONE

1. INTRODUCTION

Preamble

This chapter gives the general background information relevant to drying grain with microwave in a continuous flow state; and clearly showing points of interests in drying the grains with such mechanism. It as well shows the problem statement, objectives, justification, purpose and scope of the study.

1.1 Background

Maize (Zea Mays L.) was introduced in Uganda in 1861 (Sprague, 1987) and by 1900 was already an established crop (MAAIF, 1988). It is one of the most important grain crop in East Africa and is produced almost everywhere in Uganda under diverse environments.

Successful maize production depends on the correct application of production inputs that will sustain the environment as well as agricultural production. A number of varieties are common in Uganda and these include; Longe 1, Longe 2 Hybrid, Longe 4, Longe 5, Pan 67 and SeedC0 407.

In an average year, the yields of maize are low fluctuating around 1.5 tonnes per hectare and thus maize acreage accounts for more than 10 percent of the total area under annual crops and maize consumption accounts for about 12 percent of cereals consumption (MAAIF and UBOS, 2010).

Most of the cereal grains especially maize and rice are harvested at the peak of the rainy season, making preservation difficult and causing most of these grains to perish. This results in scarcity in the supply of the grains which leads to subsequent hunger and malnutrition, hence the need for drying of the grains.

In Uganda, grains are seen dumped on mats, bare ground, rocks and concrete slabs under sunshine in order to dry them and this is routinely seen in villages and major towns during the peak of harvest. Although much advancement has taken place in the field of drying, not much has been done in the use of microwaves in drying of maize grains in Uganda; and sun drying is by far the most dominant type of drying; this has various short comings such as delay in drying,

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