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FACULTY OF ENGINEERING

DEPARTMENT OF AGRO-PROCESSING ENGINEERING

FINAL YEAR PROJECT REPORT

Optimization of the maize drying parameters, a strategy to increase maize shelf life

BY

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A Research Project Proposal in Partial Fulfillment of the Requirement for the Award of the Degree of Bachelor of Science of Agro-Processing Engineering in the Faculty of Engineering of Busitema University

DECLARATION

I, MUKISA Moses declare that the work presented in this proposal is my own and has never been presented to any university or higher institution of learning for any academic award.

Signature.....

Date.....6/May/2014.....

APPROVAL

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

MR SSERUMAGA PAUL

Signature.....

Date...27/06/2014

MR ATOCHON SAMUEL ODONGO

Signature.....

Date.....27/6/2014

ABSTRACT

The shelf life of grains after harvest is greatly determined by its moisture content because the moisture in the grain has influence on water activity of the grain and water activity has influence on lipid oxidation, enzyme activity, non-enzymatic browning, and microbial activity and also influences grain texture. After harvesting the maize grains must therefore be dried as soon as possible since wet grains attract insects and mould (Green et al, 2005).

For drying to be effectively done, all the parameters that affect it need to be optimally controlled. Such parameters include drying temperature, time for drying, and rate of the drying air flow. Variation of such parameters affects the properties of the final dried maize grains and thus affecting its shelf life.

The methodology of this research involved varying different drying parameters combinations in a number of maize samples during the drying process. The shelf life properties such as moisture content, mould action, and degree of wrinkleless of the samples, as well as seed variability of the stored maize samples were tested after a period of 10 days and 20 days

A Graph of time against air temperature was plotted to clearly illustrate how time of maize grain drying varies at different airflow rates and drying air temperatures. Graphs of properties against temperature were plotted, to illustrate how the shelf life determining properties varies in samples dried at different drying parameter combination after given storage time intervals. A graph of germinability against drying temperature was also plotted to determine the level of viability of the maize seeds when dried at different drying parameters.

Results of shelf life were further analyzed with reference to UNBS and EAC Quality Standards. With this, an objective function equation which minimizes the shelf life reducing parameters, P was formulated. The drying parameter combination that minimizes the shelf life reducing properties, P was considered the best that optimizes the maize drying parameters.

From the study conducted on properties that reduce shelf life such as; moisture content, degree of wrinkleness, and mould action; and seed viability of the dried maize grains after storage for a period of 20 days; shelf life can be maximized when maize grains are dried at a temperature of 70^0C, airflow rate of $0.012m^3/s$, and for a period of 120 minutes

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I am so grateful to God the Almighty who has seen me through the years and who by His grace and abundant wisdom I keep succeeding.

I am indebted to my dear parents, brothers and sisters, classmates and friends to whom I extend sincere appreciation for their guidance and support and above all their prayers.

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To my good friends in the names of; Peace, Brian, Ronald, and Shaffic; thanks, you always helped me out while I was still working out the study, and I will live to remember you.

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DEDICATION

I would like to dedicate my report to my parents who have tirelessly and endlessly supported and encouraged my stay in education. May the almighty God bless and reward them abundantly.

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LIST OF ACRONYMS

EAC	–	East African Community
FAO	–	Food Agriculture Organisation
Kg	–	Kilo Gram
Kwh/m^2	–	Kilo Watt Hour per Square Meter
NARO	–	National Agricultural Research Organisation
REPU	–	Renewable Energy Policy Uganda
S/N	–	Serial Number
UNBS	–	Uganda National Bureau of Standards
UGX	–	Uganda Shillings
WFP	–	World Food Programme

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND

The shelf life of grains after harvest is greatly determined by its moisture content because the moisture in the grain has influence on water activity of the grain and water activity has influence on lipid oxidation, enzyme activity, non-enzymatic browning, and microbial activity and also influences grain texture. After harvesting the maize grains must therefore be dried as soon as possible since wet grains attract insects and mould (Green et al, 2005).

Drying refers to the systematic reduction of crop moisture down to safe levels for storage which is usually 12%-15.5% moisture content. Drying which is one of the key post-harvest operations since all down-stream operations depend on it and considered as one of the most critical points within the postharvest processing of maize grain due to its effect on the quality of the final product (Wrigley, 2010). Poor operation of this process may result into substantive losses as action of other defects like mycotoxins becomes inevitable. It is thus imperiously necessary to identify what parameter combination to undertake during drying to eliminate the causes of such deficiencies in quality of grains.

For drying to be effectively done, all the parameters that affect it need to be optimally controlled. Such parameters include drying temperature, time for drying, the relative humidity of the environment where drying is done, and rate of the drying air flow. Variation of such parameters affects the properties of the final dried maize grains and thus affecting its shelf life.

Since 1990, maize has been a cash crop in Uganda with informal exports to the region equivalent to 14-20% of total production. However, it is noted that the maize that is exported from Uganda is seasonal and dominated by wet and unclean maize leading to high levels of moisture content, fungal diseases, discoloured, and potential high Aflatoxin levels due to poor drying procedures practiced as the main criteria effecting quality. Therefore transactions have not been sufficiently successfully as the East African Community Quality standards are normally abused (Magnay, 2004).

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