



**BUSITEMA
UNIVERSITY**
Pursuing Excellence

**FACULTY OF ENGINEERING
DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION
ENGINEERING**

PROJECT



**DESIGN AND CONSTRUCTION OF A MOTORISED SORGHUM
THRESHING AND WINNOWING MACHINE**

BY

NABWAMI PROSCOVIA

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SUPERVISORS

Mr. WILBERFORCE SALANJAYE AND Mr. GODFREY SSAJJA SSALI

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DECLARATION

I Nabwami Proscovia hereby declare that information in this document is to the best of my knowledge and has not been used by anyone in any institution for any award and is entirely a result of my research.

DATE 4th JUNE 2014

SIGNATURE 



ACKNOWLEDGMENT

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ABSTRACT

Sorghum is the third most important cereal crop grown in Uganda after maize and finger millet occupying 285,000ha of arable land (<http://teca.fao.org>). It is widely grown in various districts in Uganda including: Karamoja, Kigezi, Kapchorwa on medium (2-6ha by 12% population) and large (more than 6ha 3% population) scale and on small scale (less than 2ha by 85% population) in other parts of the country (Chris Balya, 2000). Kapchorwa, Karamoja and Kigezi districts are considered to be the major producers of sorghum in Uganda and produce the best quality sorghum mainly referred to as Epuripur which yields 2500-3000kg/ha under good management and 1250-2000kg/ha at farmer level (<http://teca.fao.org>).

Harvesting is carried out by cutting the heads with knives. The harvested crop is transported to the farmer's home and spread on the ground to dry. When the drying is complete, threshing by beating the crop with sticks is done to remove the grain from the plant. This is followed by winnowing to remove chuff and bagging in plastic bags. The above processes are accompanied by high quantitative and qualitative losses, are highly tedious, labor intensive, time consuming and also pose health hazards to the personnel involved. Threshing only takes place either when needed for domestic consumption or when a market has been identified.

There are a number of sorghum threshing machines on the market which are manual, automatic, and tractor operated but some of these are slow, expensive in terms of replacing the constantly breaking belts for tractor operated thresher, the initial cost of the tractor is also high which cannot be afforded by most people in Uganda.

The thresher was designed and constructed by first sizing of the components through analysis of forces acting on the components, material selection, fabricated and assembled. The selected materials were those which would withstand the applied forces in order to avoid failure of the components during operation of the sorghum thresher.

The threshing capacity of the prototype was 108kg/h and an average threshing efficiency of 58%, average cleaning capacity of 85%, and a percentage loss of 27% obtained by carrying out three tests at rated engine speeds of 4000rpm, 3800rpm and 3600rpm of a 5HP engine using a constant feed rate of 165kg/h.

The prototype has limitations of immobility, low threshing efficiencies, threshing and cleaning losses.

The prototype costed at 1820000 UGX compared to 4500000UGX of Tonnet Agro-Engineering Company. Economic analysis of prototype was carried out using the benefit-cost method to determine its viability. The benefit-cost ratio was 1.19 since it was greater than 1 project was viable.

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LIST OF ACRONYMS

AEATREC	Agricultural Engineering and Appropriate Technology Research Centre
NARO	National Agricultural Research Organization
FAO	Food and Agricultural Organization
STP	standard temperature and pressure
Hp	Horse power
Pa	Pascal
Rpm	Revolutions per minute
Rad	radians
N	Newton
Pw	present worth
IRR	Internal Rate of Return
B/C	Benefit Cost ratio

CHAPTER ONE

1.1 Background

In Uganda, 80-90% of the population depend on farming as source of income and agriculture is the most important economic activity accounting for 43% of the Gross Domestic Product (GDP), (FAO, AGAL, (2005)). In Uganda sorghum is grown in many households as food crop for food security and also as cash crop for income generation. Sorghum is a high yielding crop, has a short growing period ranging from (90-120) days. Sorghum can be stored for a long time under good storage conditions.

Sorghum does better in hotter and drier regions for example in the North East and is one of the most extensively grown cereals. Its peculiar characteristics have made it a highly adaptable crop to the harsh conditions found in this region, Sorghum varieties grown in Uganda include; Epuripur and Sedeko which are the improved varieties developed by SAARI in 1995.

Epuripur is the most commercially grown variety because it yields high produce, matures earlier and it's tolerant to draught and diseases. In the districts where sorghum is grown, it's used for food, brewing and main source of income. Sorghum production in Uganda is entirely for the domestic market. Sorghum production in Uganda is increasing and it's spreading into central Uganda. There are approximately 200,000 households across the country producing sorghum on plots of less than one hectare. (FAO, (2005)

Processing of sorghum is gaining potential and the local market is available and growing due to increase in rate of urbanization. According to Ferris et. al (Ferris et. al, 2000), nearly 50% of urban sorghum consumption is processed and it is projected that by 2015 approximately 250,000 metric tons of sorghum will be consumed as processed products such brew, porridge and flour. The quality and quantity of processed sorghum is influenced by the quality of the threshing and winnowing methods; low quality of threshing and winnowing leads to high loss and low quality of final products. The methods normally used in threshing and winnowing are manual methods using threshing sticks and winnowing baskets, and mechanical using either automated or manual machines.

In Uganda sorghum threshing and winnowing is often done manually threshing sticks and winnowing baskets. During manual threshing and winnowing, a lot of loss of grains is

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