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## **FACULTY OF ENGINEERING**

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

### **DEVELOPMENT OF A MOTORIZED COWPEA THRESHING AND WINNOWER MACHINE**

**BY**

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*A final year project report submitted to the department of Agricultural Mechanization and Irrigation Engineering in partial fulfillment for the award of Bachelor's degree of Agricultural Mechanization and Irrigation Engineering at Busitema University*

**March 2022**

## **DECLARATION**

I **OKURUT JOSEPH** declare to the best of my knowledge that, work presented in this final year project report is from the efforts and determination that I put in my research and it has never been presented to any University or Institution of higher learning for an academic award.

Signature.....

Date.....

**APPROVAL**

This final year project report is submitted to the Department of Agricultural Mechanization and Irrigation engineering with my approval:

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**Prof. Titus B. Watmon**

Signature.....

Date.....

## **DEDICATION**

To my beloved mother Mrs. Aguti Anna Grace, my lovely sister Imocu Justine, and Madam Achom Beatrice.

## **ACKNOWLEDGMENT**

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**May the almighty God reward you abundantly.**

## ABSTRACT

**Cowpea (*Vigna Unguiculata*)** is the third most important legume crop in Uganda after common bean and groundnut. It is tolerant to dry season and is a short season crop with most varieties maturing in a range of 72 to 90 days. It is consumed in different forms such as dry seeds, green pods, and young leaves. High protein and carbohydrate contents with relatively low-fat content and complementary amino acid pattern to that of cereal grains make cowpea an important nutritional food in the human diet. An average cowpea grain contains (23 – 32) % protein, (50 – 60) % carbohydrate and about 1% fat in dry basis. In Uganda, threshing and winnowing of cowpeas are widely done manually. The manual threshing of cowpeas involves beating with sticks which is tedious and labor intensive. This process (manual threshing) causes physical damage to grains where extra force is used, and results in a low output (50 to 60 kg of threshed cowpea/hour). On the other hand, traditional winnowing requires plenty of wind, presents health hazards to workers due to inhalation of dust and dirt, it is labor intensive, tedious, and a low output (40 to 50 kg of clean grain/hour) is achieved. The motorized cowpea threshing and winnowing machine was designed, fabricated and its performance evaluated. It addresses the above challenges of manual threshing and traditional winnowing. There is increased threshing and winnowing output thus time saving, increased threshing and cleaning efficiency, elimination of drudgery, and improvement of workers' health. The farmer can earn more income after the sale of good quality grains produced from the machine. The machine is affordable to most farmers and easy to operate, repair and maintain. The machine is composed of components such as; the hopper, the threshing cylinder, the concave sieve, the winnowing chamber, the blower, the chaff outlet, the clean grain outlet, V-belt drive and pulley system for power transmission, pillow block bearings, and the frame to support the machine components. It was fabricated using Mild steel plates and Mild steel angle bars. The machine is powered by a 2 hp single phase AC motor, but it can as well be powered by a petrol engine for use in villages where there is no electricity. The performance evaluation tests that were carried out on the machine using SECOW 2W variety of cowpeas at threshing cylinder speed of 355 rpm and blower speed of 710 rpm indicated average threshing efficiency of 96.07%, cleaning efficiency of 97.02%, cleaning loss of 2.01% and percentage seed damage of 0% at machine capacity of 74 kg of clean grain/hour. Other varieties of cowpeas can as well be threshed and winnowed by the machine upon replacement of the concave sieves of the right perforation diameters corresponding to the sizes of the different cowpea seeds. This machine can also thresh and winnow soybeans and green gram.

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## **List of Abbreviations**

rpm – revolutions per minute

UBOS – Uganda Bureau of Statistics

MAAIF – Ministry of Agriculture, Animal Industry and Fisheries

SECOW – Serere Cowpeas

FAOSTAT – Food and Agricultural Organization Statistics

NPV – Net Present Value

P.I – Profitability Index

MS – Mild Steel

A.C – Alternating Current

hp - horsepower

UCA – Uganda Census of Agriculture

NaSARRI – National Semi Arid Resources Research Institute

% w.b – percentage wet basis

UGX – Uganda Shillings

PVF – Present Value Factor

BCR – Benefit-Cost Ratio

PV – Present Value