



**BUSITEMA
UNIVERSITY**
Pursuing Excellence

FACULTY OF ENGINEERING

**DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION
ENGINEERING**

FINAL YEAR PROJECT REPORT

**DESIGN AND CONSTRUCTION OF A SOLAR POWERED CHEMICAL
SPRAYER FOR SMALL SCALE FARMERS**

CASE STUDY: TORORO DISTRICT

BY

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This project report is presented to the department of agricultural mechanization and irrigation engineering as a partial fulfillment for the award of a Bachelor's degree in Agricultural mechanization and irrigation engineering at

Busitema University

ABSTRACT

A sprayer is a mechanical device used to spray the liquid chemicals like herbicides, pesticides, fungicides and fertilizers to the crops in order to control pests and diseases on crops to maximize production. Sprayers are of many different kinds which include knapsack sprayers, motorized sprayers, tractor drawn sprayers etc. the most commonly used type by the Ugandan farmers are the knapsack sprayers because they are cheap in terms of capital cost. The main drawback with these sprayers is that they cannot be used for long working hours due to human drudgery and they also have low pressure. Motorized sprayers have high pressure but with high investment cost and maintenance cost. Due to the above shortcomings of the commonly used sprayers, the need for another means which provide output in between the knapsack sprayers and the motorized sprayers calls for the invention of solar powered sprayers. These can have between low to high pressure depending on the capacity of the pump. These sprayers also cost moderately and have low maintenance costs.

For this project, the emphasis was put on the design, construction and testing for the performance of a solar powered sprayer using low power pump and solar panel. During the design process, the required solar panel, pump, battery and angle of solar panel inclination were obtained based on the required output of $1\text{m}^3/\text{min}$ of the chemical. The system was tested under varying conditions of insolation strengths an angle of inclination of the solar panel. It was observed that the rate of discharge is affected by the strength of solar insolation and angle with the appropriate angle being 45degrees. The cost analysis was also carried out using the method of net present value over four year period with interest rate of 10% and the NPV value got was Ugx.**7,807,622** which is positive hence making the project feasible. Implementation of this project will help in saving costs spent on fuel purchase and reduce the spraying time due to moderate pressure and improve on the yield in ground nut.

DECLARATION

I, **OTHIENO FRANCIS**, declare that the information in this report is my own work and was compiled from September 2017 to May 2018

Name: OTHIENO FRANCIS

Signature:

Date:

DEDICATION

I dedicate this project report to my parents Mr. **CHARLES MENYA** and Mrs. **SALUME AURO** and my siblings for the selfless care and support you have always provided to me. I thank you for the spirit of hard work, courage and determination you have instilled in me throughout my school days till today. May the almighty God bless you abundantly

ACKNOWLEDGEMENT

First of all, I take this opportunity to thank the almighty God for guiding me during my information gathering, project system design, fabrication of the prototype, testing of the system and report writing. Special thanks also go to my precious family for their constant support both financially and spiritually.

Special thanks go to my supervisors Mr. Kilama George and Mr. Igga Huzzairu for the constant support they have given me during the process of working on this project for their useful advice and comments given to me during the prototype production and report writing.

Finally, special appreciation goes to my fellow colleagues with whom I study with for their inspiring words of counsel and wisdom for all the years we have spent together. May the Good Lord bless and reward you all with success.

APPROVAL

This is to certify that **OTHIENO FRANCIS** has written this report after collecting the needful information needed for the full operation of the project under the supervision of:

MAIN SUPERVISOR

Name: Mr. KILAMA GEORGE

Signature.....

Date:

CO-SUPERVISOR

Name: Mr. IGGA HUZAIRU

Signature:

Date:

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CHAPTER ONE: INTRODUCTION

1.0 Introduction.

This chapter contains the background of the study, problem statement, objectives, purpose, justification and the scope including the limitation to the study.

1.1. Background of the study

A sprayer is a mechanical device used to spray liquid chemicals like herbicides, pesticides, fungicides and fertilizers to the crops in order to protect them from pest and disease attack. Sprayer provides optimum utilization of pesticides or any liquid with minimum efforts.

Dusters and sprayers are generally used for applying chemicals. Dusting is the simpler method of applying chemicals and dusters are best suited for portable machineries and this usually requires simple equipment. But these devices are less efficient than sprayers, because of the low retention of the dust (*Johanningsmeier, 2000*).

The invention of a sprayer brought revolution in the agriculture sector. This enables farmers to obtain the maximum agricultural output since the pests and diseases that reduce the yield are controlled easily. They are used for agriculture spraying, garden spraying, weed and pest control, liquid fertilizing and plant leaf polishing. There are many advantages of using sprayers such as easy to operate, maintain and handle, it facilitates uniform spread of the chemicals, capable of throwing chemicals at the desired level, precision made nozzle tip for adjustable stream and capable of throwing foggy spray, light or heavy spray, depending on requirement (*Rajesh et al., 2007*).

Sprayers are available in different varieties (*Sciences, 2008*). In Uganda farmers generally use two types of spray pumps for spraying; hand operated spray pump (knapsack sprayers) and fuel operated spray pump. The hand operated spray pumps are most popular. This is because most farmers are small scale agriculturalists who find hand operated sprayers cheap to purchase, easy to operate and maintain. The main drawback of hand operated spray pump is that it cannot be used for long working hours. Fuel motorized sprayers on the other hand give high pressure output which reduces the spraying time required. These motorized sprayers have high initial, maintenance and running cost which makes it hard for small scale farmers to purchase and maintain them. Due to the above drawbacks by the commonly available sprayers, there is need

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