BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OFAGRICULTURAL MECHANIZATION AND IRRIGATION ENGINEERING

DESIGN OF A FLEXIBLE RAIN GUN SPRINKLER IRRIGATION SYSTEM FOR AMARANTH

BY

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ABSTRACT

The need of modern systems of irrigation that are flexible, reliable and movable in Uganda is of great improvement in Uganda's agricultural sector, Due to its tropical location, Uganda is endowed with a variety of grains and vegetables, yet their production keeps on reducing and fluctuating due to farmers relying on rainfall which is seasonal, inadequate and not uniformly distributed and using irrigation systems that they consider expensive, inflexible and unreliable

Approximately 19% of Uganda's population is under nourished, Grain amaranth is a fast growing, high yielding, nutritious crop with potential to contribute to the alleviation of malnutrition and nutritional deficiencies. This design project seeks to reduce the increased fluctuation of amaranth production in Uganda, as a strategy to improve food security, nutrition and household income.

Information about amaranth production both the vegetable and the grain especially in Uganda and rain gun sprinkler irrigation systems was gathered.

To aid in the design, climatic data (Rainfall, Temperature, Relative humidity, Sunshine and win speed) was collected. Soil and water tests were also carried out to obtain the suitability of the soil and water for the crop. A topographical survey using a Global Satellite device (GPS) was also carried out to determine the topographical data of the plot, proximity and availability of resources relevant to the design.

Different software such as Microsoft Excel, Matlab programming language, CROPWAT 8.0 and CLIMAT 2.0, EPANET software were used to analyze the data and AutoCAD software to generate the design drawings.

Important results of a movable rain gun sprinkler irrigation system with a system capacity of 7.63 m^3/hr, crop water need of 5.287mm/day total head of 82.57 m. Pump specification ; Davey 5290 HE water Pump with a maximum head of 90 m and power of 9 hp.

Furthermore the design project quotation was included to assess the feasibility of farmers adopting the technology.

In conclusion, the design project is very possible in Naalya village given the readily available water resource of the flowing non seasonal stream.

DECLARATION

I KABUNGA James with registration number BU/UG/211/57 hereby declare that this design project report is my original work except where explicit citation has been made and it has not been presented to any institution of higher level of learning for any academic award.

Signature.....

Date.....06/07/2015.....

APPROVAL

This is to certify that the project proposal under "Design of a flexible rain gun sprinkler irrigation system for amaranth in Naalya" has been done under my supervision and it is now ready for examination.

Main Supervisor: Madam Abbo Jackline

Sign.....

Date: .....

Co-supervisor: Mr. Ssajja Ssali

Sign.....

Date: .....

Department of Agricultural Mechanization and Irrigation Engineering

DEDICATION

I dedicate this work to my parents, Mr. and Mrs. Nyanzi Steven who have tirelessly put in all their efforts to see me reach this time in my education career.

May the good Lord bless them.

ACKNOWLEDGMET

I give thanks to GOD for HIS unlimited grace and love upon me

I extend my gratitude to all lecturers at the Faculty of Engineering, Department of Agricultural; Mechanization and Irrigation Engineering for equipping me with academic knowledge which has guided me up this far.

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Lastly but not least, I extend special thanks to all my friends and colleagues for their support to me in my endeavours to complete this work. May the Almighty God bless you abundantly, above all you expected

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LIST OF ACRONYMS

UBOS- Uganda Bureau of Statistics

NEPAD - New Partnership for Africa's Development

CAADP- Comprehensive Africa Agriculture Development Program

SIRACO- Sustainable Irrigation and Consultancy Company Limited

PVC - Polyvinylchloride

TDH – Total Dynamic Head

Kc – Crop coefficient

g – grams

mg – milligrams

PN -working pressure

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1. INTRODUCTION

1.1 Background

Uganda's agricultural sector is largely dependent on rain-fed agriculture. Overall, 96% of the parcels in Uganda depend on rain as their main source of water while 3% parcels were reported using swamps or wetlands as their main water source (2.9%) and only 1% using irrigation as their main source of water (UBOS, 2007). Despite this, prolonged drought is a key climate variability disaster which has already occurred in Uganda and has affected community livelihoods and the economy. The droughts which used to last for a period of 3 months currently they have been extended to about 4-6 months. This presents much stress to both food and cash crops and results in low productivity and at extreme there is complete death of the crops. (J. Zake, 2012). About 70% of the country receives bimodal rainfall, allowing two cropping seasons per year with the peak rainfall periods in April–May and September–November; the most intense dry season being June–August (NEPAD, 2004)

Approximately 19% of Uganda's population is undernourished and the incidence of micronutrient deficiencies, especially Vitamin A and iron deficiency, are unacceptably high. Grain amaranth is a fast growing, high yielding, nutritious crop with potential to contribute to the alleviation of malnutrition and nutritional deficiencies. However, its production and consumption in the country is dismal and fluctuates especially during the dry season. (J. Muyonga *et al*, 2010). This project seeks to promote production and utilization of grain amaranth in Uganda, as a strategy to improve food security, nutrition and household income. The project is aimed at contributing to the improvement of livelihoods of resource poor communities in Uganda through increased agricultural production of grain amaranth, increased consumption of grain amaranth and amaranth products as well as introduction of value added products.

Traditional methods, furrow, manual foot pump, solid-set irrigation systems have been used however farmers have considered them inefficient, unreliable, labor intensive, inflexible and insecure. A movable rain gun sprinkler irrigation system has high irrigation application efficiency, easy to design, install and operate, can be adapted for all types of soils, many kinds of

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