BUSITEMA UNIVERSITY

Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OFAGRICULTURAL MECHANIZATION AND IRRIGATION ENGINEERING

DESIGN AND SIMULATION OF A DRIP IRRIGATION SYSTEM FOR CLOSELY SPACED CROPS

BY

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ABSTRACT

The introduction of drip irrigation systems that can water closely spaced crops is a great improvement in Uganda's agricultural sector; this is as a result of continued wastage of farmers' cultivable land as a result of use of the existing drip irrigation systems. 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.

Solanum Aethiopicum (Nakati) is the most important vegetable to the people of central Uganda. Nakati is the most abundant leafy vegetable found in Kampala markets, with a relatively higher and stable market price in comparison with other vegetable species. Farmers reported that Nakati remains stunted during prolonged drought and re-grows fairly well when soil moisture becomes available.

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, CROPWAT 8.0 and CLIMAT 2.0, IRRIGATE PLUS software were used to analyze the data and AutoCAD 2013 software to generate the design drawings.

Important results for the design of the drip system with porous pipes include; system capacity of 193.103LPM, crop water need of 3.59mm/day, total operating head of 10.62 m. Pump specification ; DC 50P water Pump with a maximum head of 20.785 m and power of 5.27hp.

Furthermore the design project quotation of total 5,600,000 is included to assess the feasibility of farmers adopting the technology.

In conclusion, the design project is very possible and economically viable therefore I strongly urge farmers to take it up.

DECLARATION

I NAMIREMBE RACHEAL with registration number BU/UG/2012/16 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....2nd June...2016..

APPROVAL

This is to certify that the project proposal under "Design and simulation of a drip irrigation system for closely spaced crops" has been done under my supervision and it is now ready for examination.

Main Supervisor: Mr. Muyingo Emmanuel

Sign.....

Date: .....

Co-supervisor: Mr. Kimera David

Sign.....

Date: .....

DEDICATION

I dedicate this report to my family, the Kizito family. Thanks for educating me.

ACKNOWLEDGEMENT

I am so grateful to the almighty God for the protection He has granted me a long way in a successful completion of this work. Special thanks to my dear parents and family for the great love, support and heartfelt prayers. I will always be indebted to my supervisors Mr Muyingo Emmanuel and Mr Kimera David, friends; Mr Kabugo Emmanuel, Nabawanuka Prossy, Galiwango Hillary and Kabunga James for their unconditional support in this venture that has enabled me to successfully complete this programme.

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CHAPTER ONE

1.0INTRODUCTION

1.1 Background of the study

With agriculture contributing to about 23.9 percent of Uganda's GDP, 48percent of export earnings and employing 72 percent of the total population aged 10 years and above, agriculture is no doubt the back bone of Uganda's economy, with 38 percent land cover for agricultural use. (UBOS 2014) most of the agriculture is rain fed with 96 percent of the farmers depending on rain, 3 percent depending on swamps and or wetlands and 1 percent of ordinary farmers using irrigation (UCA 2009)

Uganda generally enjoys two rain seasons i.e. march-May and October –December, leaving much of January-march and June- October idle. The annual average temperature is 26 degrees and never exceeds 27 degrees. With recent reports indicating erratic weather patterns, the livelihoods of households surviving on agriculture are threatened. (MWE 2007) thus the only solution to boost agricultural production, ensure food security and increase household incomes is to embrace irrigation.

Irrigation systems should apply the amount of water needed by the crop in a timely manner without waste or damage to soil, water, air, plant, and animal resources. Irrigation application method and system selection should result in optimum use of available water (National Irrigation Guide Handbook).Conventional water systems such as sprinklers and hand- held hoses are inefficient due to significant amounts of water being lost to runoff and evaporation through wind. Irrigation systems that apply water directly to the soil in a slow steady flow are a much more efficient option in our dry climate that is to say, drip irrigation systems that are comprised of various types of water applicators releasing water one drop at a time in a steady drip-drip rhythm. A drip line is a small diameter hose usually made of light weight plastic that has tiny emitters embedded in it at a fixed spacing. Also made from recycled car and truck tires are soaker hoses, round like garden hoses but very porous. When filled with water, they weep all over allowing water to soak slowly into the soil around plants.

REFERENCES

- UBOS, (2014), Uganda Bureau of Statistics, Uganda National Household Survey, 2005/06: Report on the agricultural module. Kampala, Uganda
- Joshua Zake, 2012. Adaptation to Prolonged Droughts in Central Uganda; Appropriate Irrigation Technology as a Practical Option for Smallholder Farmers
- NEPAD–CAADP, 2004 Vol.II, Smallholder Irrigation Development and Water Harvesting Project
- A National Irrigation Master Plan for Uganda (2010 - 2035) Volume 2
- L.S. Pereira., R.G. Allen., 1999. Irrigation and Drainage Handbook
- Doorenbos.J. and W.O.Pruitt, 1975, Guidelines for Predicting Crop Water Requirements
- FAO, 2001 Irrigation manual; planning, Development, Monitoring and Evaluation of Irrigated Agriculture with Farmer Participation Volume III, Module 8
- CK Ssekabembe, C Bukenya & W. Nakyagaba, 2003, Traditional knowledge and practices in local vegetable production in central Uganda
- Perrier, A. 1985, Updated evapotranspiration and crop water requirement definitions. *Crop Water Requirements*,