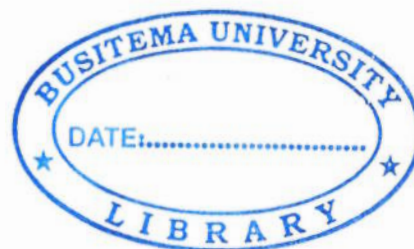




**BUSITEMA
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**DEPARTMENT OF AGRICULTURAL
MECHANIZATION AND IRRIGATION ENGINEERING**

**EVALUATING ON-FARM WATER PRODUCTIVITY OF FURROW,
BASIN AND HOSEPIPE IRRIGATION METHODS IN TOMATO
PRODUCTION UNDER SUPPLEMENTARY IRRIGATION
CASE STUDY: KABOS, SERERE DISTRICT, UGANDA**

**BY
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BU/GS16/MID/3**

Research Report Submitted to the Department of Agricultural Mechanization and Irrigation Engineering in Partial Fulfillment of the Requirements for the Award of Master of Science in Irrigation and Drainage Engineering of Busitema University.

July 2018

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ABSTRACT

The research was carried out on evaluation of on-farm water productivity in tomato production using surface and overhead Irrigation techniques at Kabos Horticulture and Irrigation site in Serere district, Eastern Uganda. The aim of this study was to Evaluate On-Farm Water Productivity of Tomato Crop under Furrow, Basin and Hosepipe Irrigation Techniques. Soil samples from the study area revealed two predominant soil textural classes, i.e Clay loam and clay with field capacity ranging from 30% to 40% and low average permanent wilting point. Crop and soil data were fed into CROPWAT model to determine the crop water requirement. Irrigation scheduling revealed a relationship that Irrigation water need is inversely proportional to precipitation received. It was also clearly observed that Irrigation water decreases towards the growing season attributed to low water demand by crops due to maturity. Plant growth was monitored at 20DAT, 40DAT and 70DAT (DAT -days after transplanting). Plants under treatment 1 and 2 (flat fields) had better mean growth height compared to others due to easy drainage and good soil aeration. Statistical data analysis was completed by Excel and GENSTAT for a Randomized Complete Block Design (RCBD). Here, Marketable yield reduces with poor water management practices seen at treatment 6 and 5 where surface ponding instigated disease, root damage and fruit rotting. Basin High had the least Marketable water productivity of 1.2291 Kg/m³ whereas Water productivity was highest (2.07 Kg/m³) in Furrow Irrigation Treatments. Analysis of variance on water productivity revealed that $F_{cal} < F_{tab}$ at $\alpha = 0.05$ and 0.01, an indication that the experiment failed to reject the null hypothesis that "Irrigation method does not improve on-farm water productivity of tomato crop". This research supports the UN Sustainable Development Goal 6 - ensuring water availability, sustainability in management and sanitation for all. The findings in this research can help alleviate the pressure being imposed on global water for agriculture, animal and industrial uses.

Key Words: Irrigation, Crop water requirement, CROPWAT, Marketable yield, Water productivity

DECLARATION

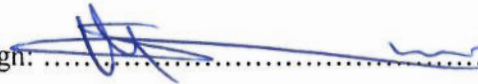
I, **GASHALI TOM**, declare that this research is my original work and has not been submitted for any award to any other Institution or University before. Any other author's work that was used in creating an establishment for the study reported in this thesis has been duly acknowledged.

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5/9/2018

APPROVAL

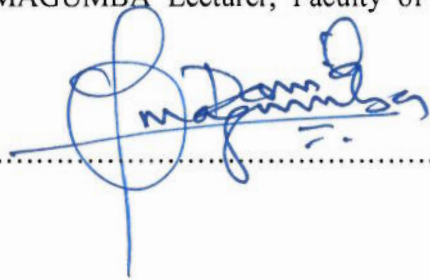
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DEDICATION

This work is dedicated to all current and up-coming students and entire stakeholders of Divine College, Buyaga and my wife Namutosi Fatuma.

TABLE OF CONTENTS

ABSTRACT.....	i
DECLARATION	ii
APPROVAL	iii
ACKNOWLEDGEMENTS.....	iv
DEDICATION.....	v
LIST OF FIGURES	viii
List of Tables	ix
ABBREVIATIONS AND ACRONYMS.....	x
CHAPTER ONE: INTRODUCTION.....	1
1.1 Background	1
1.2 Problem statement.....	2
1.3 Objectives of the study.....	2
1.3.1 Main objective	2
1.3.2 Specific objectives.....	2
1.4 Research questions:.....	3
1.5 Hypotheses.....	3
1.6 Scope:.....	3
1.7 Justification:	3
CHAPTER TWO: LITERATURE REVIEW.....	4
2.1 Irrigation.....	4
2.1.1 Full Irrigation	4
2.1.2 Supplemental Irrigation (SI):.....	4
2.1.3 Concept of Deficit Irrigation.....	6
2.1.4 Crop Water Requirement and CROPWAT Model	7
2.1.5. Net and Gross Irrigation Water Requirement.....	7
2.1.5 Irrigation methods/technologies.....	9
2.2 Water Productivity (WP) and Water Use Efficiency (WUE)	13
2.3 Tomato growing.....	14
2.3.1 History and background.....	14
2.3.2 Tomato growth requirements.....	14

2.3.3 Plant population and spacing	16
2.3.4 Fertilizer application	17
2.3.5 Water Requirements.....	17
2.3.6 Trellising	18
2.3.7 Pruning.....	19
2.3.8 Pests and disease control.....	19
2.4 Soil characteristics.	19
2.4.1 Physical soil characteristics	20
2.4.2 Soil chemical nutrients.....	21
CHAPTER THREE: METHODOLOGY	23
3.1 The Research site, Materials and Methods used in the study	23
3.2 Specific objective 1	24
3.2.1 Soil sampling and analysis.....	24
3.2.2 Assessing soil texture.....	25
3.2.3 Determination of FC, PWP and Bulk Density.....	25
3.2.4 Soil chemical nutrients.....	26
3.3 Specific objective 2	26
3.3.1 Crop water requirements.....	26
3.3.3 Determination of net Irrigation water requirement (NIR)	28
3.3.4 Irrigation Scheduling	28
3.4 Specific objective 3	29
3.4.1 Description and Randomization Procedure of the Design	29
3.4.2 Procedure in the analysis of Variance from RCBD experimental data	30
3.4.3 Set up of the experimental garden	31
3.4.4 Monitoring crop growth and yield	32
3.5 Specific objective 4.....	32
3.5.1 Yield per plot	32
3.5.2 Marketable yield (t/ha):.....	33
3.5.3 Unmarketable yield (t/ha):.....	33
3.5.4 Gross yield (tons/ha):.....	33

3.5.5 Water productivity (WP) for tomato crop.....	33
CHAPTER FOUR: RESULTS AND DISCUSSION	34
4.2 Determination of the crop water requirement (ET _c).....	36
4.2.1 The reference crop evapotranspiration (ET _o)	36
4.2.2 Calculation of crop factor (K _c).....	37
4.2.3 Determination of crop water requirement and Irrigation water requirement.....	38
4.3 Crop growth and yield.....	41
4.3.1 The plant height	41
4.3.2 The Analysis of Variance of plant height amongst treatments	42
4.3.4 The crop yield	44
4.4 The water productivity for tomato crop	45
CHAPTER 5: CONCLUSION AND RECOMMENDATION	48
5.1. Conclusion	48
5.2. Recommendation.....	48
REFERENCES	50
Appendix 1: Average crop height at initial stage.....	54
Appendix 2: Average crop height at crop development stage	54
Appendix 3: Average crop height at late-season (harvest) stage	54
Appendix 4: Gross yield in Kg per treatment plot.....	54
Appendix 5: Marketable yield in Kg per treatment plot	55
Appendix 6: Non-Marketable yield in Kg per treatment plot.....	55
Appendix 8: Productivity from a unit of water for selected commodities.....	56
Appendix 10: Soil structural triangle	58
Appendix 11: Percentage Points of the F-Distribution at 5% C.I.....	59
Appendix 12: Percentage Points of the F-Distribution at 1% C.I.....	60
Appendix Photo:	61

LIST OF FIGURES

Figure 1: Fluctuation of soil moisture content in three different conditions of rain-fed farming...	5
Figure: 2 Location of experimental site at Kabos in Serere District.....	23

Figure 3 Experimental field lay out	32
Figure 4 Infiltration test result	35
Figure 5 A plot of the Kc values	38
Figure 6 Relationship between water requirement and IWR against growth stages.	39
Figure 7: Relationship between rainfall and crop water need.....	40
Figure 8: Comparison of plant height at three stages	41
Figure 9: Variation of canopy cover with growth days	44
Figure 10: Comparison of yield for different treatments	45

List of Tables

Table 1: Sensitivity of various field crops to water shortages	6
Table 2: Water Use Indices	14
Table 3: Required temperature ranges per crop stage for optimum tomato production	15
Table 4: Plant population guide	17
Table 5 Format of ANOVA Table	31
Table 6 Treatment applied to experimental plots	31
Table 7: Physical soil Characteristics	34
Table 8: Output of soil physical properties.....	35
Table 9: Chemical properties of soil samples	36
Table 10: Average climatic parameters from CLIMWAT 2.0	37
Table 11: Shows crop water requirement from CROPWAT model	38
Table 12: Mean crop height at three stages	41
Table 13: Mean Height at 40 DAT	42
Table 14: Average Height at 70 DAT.....	42
Table 15: Canopy Cover results.....	43
Table 16: Average yield per treatment plot	44
Table 17: Water productivity per treatment.....	46
Table 18: Water productivity	47
Table 19 ANOVA Gross Water Productivity	47
Table 20 ANOVA for Total Marketable Water Productivity	47

ABBREVIATIONS AND ACRONYMS

ANOVA	Analysis of Variance
CWP	Crop Water Productivity
CWPF	Crop Water Production Function
DAT	Days after transplanting
DI	Deficit Irrigation
ET	Evapotranspiration
Eta	Actual evapotranspiration
ET _c	Crop evapotranspiration
ET _{crop}	Crop Evapotranspiration
ET _o	Reference Evapotranspiration
ET _{rel}	Relative Evapotranspiration
EWP	Economic Water Productivity
FAO	Food and Agriculture Organization
FC	Field Capacity
GIR	Gross Irrigation Required
MAD	Maximum Allowable Deficit
MSWD	Maximum Soil Water Deficit
MSWS	Maximum Soil Water Storage
NIR	Net Irrigation Water Requirement
OMC	Organic Matter Content
PWP	Permanent Wilting Point
RCBD	Randomized Complete Block Design
SI	Supplemental Irrigation
t/ha	tone per hectare
TAW	Total Available Water
TWU	Total Water Use
WP	Water Productivity
WUE	Water Use Efficiency
WUI	Water Use Index

CHAPTER ONE: INTRODUCTION

1.1 Background

Tomato (*Lycopersicon esculentum* Mill) is one of the most important and has the highest acreage of any vegetable crop in the world (Jensen et al., 2010). In 2010, its global production was approximately 145.6 million tons of fresh fruit. (Matos et al., 2012). Global production levels of vegetables tomatoes inclusive increased by 55% between 1993 and 2003 (Robinah Sonko et al., January 2005), the majority of this increase coming from area expansion. Growth in productivity (yields per unit area) is limited with approximately 0.5% annually. In Uganda total vegetable production increased with 23% to a total of 556,000 Mt in 2003. Given the area increase of 30% a logical conclusion is that overall productivity of vegetable production declined.

Water resources are essential for human existence as well as for agricultural Irrigation. It is widely acknowledged that irrigated agriculture uses almost 70% of the global freshwater. In many developing countries, growing demand for Irrigation, as well as increased population and limited management are placing increasing pressure on water resources. To maintain sustainable water use in agriculture and ensure food security, a substantial improvement in agriculture Water Productivity is required (Fish man R. *et al*, 2015).The increasing worldwide shortages of water and costs of Irrigation are leading to an emphasis on developing methods of Irrigation that minimize water use (maximize the Water Productivity) (Hamlyn G. Jones, 2004)

The Water Productivity term plays a crucial role in modern agriculture which aims to increase yield production per unit of water used, both under rainfed and irrigated conditions. This can be achieved either by; increasing the Marketable yield of the crops for each unit of water transpired, reducing the outflows/ losses, or enhancing the effective use of rainfall, of the water stored in the soil, and of the marginal quality water (Ragab Ragab, 2014).Helen Fairweather of Irrigation Insights Volume 5, advanced that improving the efficiency and effectiveness of water use can result from better managing a number of factors, including water availability, fertility, pests and diseases, crop or pasture variety, planting date, soil water conditions at planting .plant density and row spacing. This means that improving water productivity requires an understanding of the whole system and should not focus solely on the application of water. Based on the above, this study evaluated the growth and yield of tomato crop, under different Irrigation methods in Kabos, Serere district in eastern Uganda.

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