

**BUSITEMA
UNIVERSITY**
Pursuing Excellence



DISSERTATION

**THE POTENTIAL IMPACT OF TEMPERATURE
VARIATIONS ON COFFEE PRODUCTION IN MITYANA
DISTRICT, UGANDA**

By

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FEBRUARY, 2021.

Declaration

I Susan Naddamba, declare that this research is my original work and has not been submitted to this university or elsewhere for funding and partial fulfilment of any award or publication. Where other people's work has been cited, this has been clearly acknowledged in accordance with the Busitema University's requirements.

Signature:  Date: 9th / 02 / 2021

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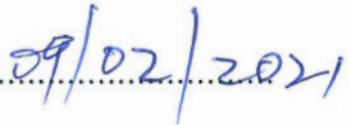


Approval

This dissertation has been submitted for external examination with our approval as the student's supervisors.

Signed..........

Professor Isabirye Moses

Date..........

Signed..........

Associate Professor Ochwoh Victor Akangah

Date..........

Dedication

To my children, Hannah, Victor and Samara. You gave me a reason to pursue this to the end.

Acknowledgement

First, I thank God for His mercies and blessings, may His Holy Name forever be glorified.

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LIST OF ACRONYMS

| | |
|-----------------|--|
| CMIP5 | Coupled Model Intercomparison Project phase 5. |
| CO ₂ | Carbon dioxide |
| ENSO | El Niño Southern Oscillation |
| ETc | Crop Evapotranspiration |
| GCMs | Global Circulation Models |
| GDP | Gross Domestic Product |
| GHG | Greenhouse gas |
| IPCC | Intergovernmental Panel on Climate Change |
| LTM | Long-term Mean |
| MAAIF | Ministry of Agriculture, Animal Industry and Fisheries |
| m a.s.l. | meter above sea level |
| MPI-ESM | Max Planck Institute – Earth System Model |
| NAADS | National Agricultural Advisory Services |
| NAPA | National Adaptation Program of Action |
| NARO | National Agricultural Research Organization |
| NACoRI | National Coffee Research Institute |
| OWC | Operation Wealth Creation |
| RCA | Research for Climate Action |
| RCP | Representative Concentration Pathways |
| SRES | Special Report on Emissions Scenarios |
| UCDA | Uganda Coffee Development Authority |
| UN | United Nations |
| UNMA | Uganda National Metrological Authority |

Abstract

Overall, unfavourable temperatures are the major climatic limitations for coffee production. These limitations are expected to become increasingly important in several coffee growing regions due to the recognized changes in global climate where unfavourable temperatures constitute major constraints to coffee yield. The present study focuses on the impact of temperature variations on Robusta coffee production in Uganda taking Mityana district as the case in study in particular. Specifically this study aimed at determining how the variations in temperature affect coffee yields and what strategies can be taken to manage and adapt to these conditions.

The data used was temperature and coffee yield data. Monthly historical temperature data for the period 1950-2017 and monthly projected temperature data for the period 2018-2050 basing on the climatic scenarios of the Representative Concentration Pathways (RCPs) 4.5 and 8.5 was obtained at a resolution of 0.05°0.05 as a CMIP5 data set using the MPI-ESM Model from the climate data library (ICPAC). The coffee yield data was acquired from the Coffee Research Centre in Kizuza (NaCoRI). All this data was secondary data particularly for Mityana district only.

Temperature – Time series analysis was done to determine the variation in the trend of temperature with time and this was achieved using the graphical interpretations and the Mann Kendall statistical analysis test. Then the second objective of establishing the implication of the temperature trend on the Robusta coffee plant was achieved using suitability modeling.

The result showed that there is a significant increasing trend in surface temperatures with time, both historically and as expected under the climatic scenarios. However it was established that this increase will not negatively affect the Robusta coffee growth and development but it shall be used as an advantage to the farmers to plan on how to improve on the coffee yields with the prevailing temperature conditions. Any decline in the yield productivity was noted to have been either as a result of low temperatures or better explained by other factors like pests and diseases, management factors, etc.

The study concluded that the temperatures have been and are still increasing but farmers are aware of this and have embarked on management and adaptation strategies to sustainably grow the Robusta coffee crop. However there is need to look at technologies that maintain and improve on yield productivity with the existing climatic conditions.

CHAPTER ONE

INTRODUCTION

1.0 Background to the study

The Ugandan economy is largely dependent on agricultural commodities and contributes about 26% to the GDP and 46 percent of export earnings (Nahanga, Bamwesigye and Darkwah, 2015) while employing about 72 percent of Uganda's working population (UBOS 2016).

Coffee, along with tea and cotton, is one of Uganda's largest exports. Coffee contributes 20-30% of Uganda's foreign exchange earnings (Kangire *et al.* 2017). However, unfavorable variations in climate, among other factors, have affected the growth and development of the coffee plants and therefore yields (Camargo, 2010).

The Inter-governmental Panel on Climate Change (IPCC) report 2018, forecasts an increase in mean annual temperature of between 0.7 °C and 1.5 °C by the 2020's and of between 1.3 °C and 4.3 °C by the 2080's globally. It suggests that if global greenhouse gas emissions remain high then we are more likely to see temperatures in the top end of this range. According to Hepworth and Goulden (2008) East Africa has seen a warming trend of about 0.5 °C and has become wetter on average by around 10-20% over the past 100 years. They further stated that human induced climate change is likely to increase average temperatures in Uganda by up to 1.5 °C in the next 20 years and by up to 4.3 °C by the 2080s above pre-industrial age. On this basis, Haggard & Schepp (2011); Camargo (2010) forecast that the sustainability of the coffee industry faces serious challenges in the coming decades.

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