BUSITEMA UNIVERSITY
Faculty of Natural Resource and Environmental Sciences

SUGARCANE CARBON SEQUESTRATION POTENTIAL UNDER THE CLEAN DEVELOPMENT MECHANISM

THE CASE OF KAKIRA SUGAR ESTATES

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A Research report submitted to the Faculty of Natural Resource and Environmental Sciences in partial fulfillment of the award of the degree of Bachelor of Science in Natural Resource Economics of Busitema University

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Declaration

I, Sekajugo John do hereby declare that this research work has been through my own efforts and never has it been submitted to Busitema University or any other Institution of higher learning for the award of a degree or any other qualification.

.... Date: 07/06/2023

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Approval

This is to confirm this research report is original and has only been through the efforts of Sekajugo John after pursuing a three year Bachelor of Science degree in natural resource economics of Busitema University. He has therefore fulfilled part of his requirements for the award of the degree in Natural Resource Economics of Busitema University.

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Dedication

To the Almighty father for protection and guidance he has granted me throughout my period of study. I glorify his name.

Also to my dear father Mr. Birungi Joseph and my two beloved mothers, Mrs. Namayanja Sarah and Mrs. Nansaale Harriet. Without their care, support and advise, I would not have come to the completion of this course.

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Acronyms

AG	Above ground
acc-SMD	accumulated Soil Moisture Deficit
BIO	Microbial biomass
BG	Below ground
CPRS	Carbon Pollution Reduction Schemes
Co_2	Carbon dioxide
C	Carbon
CERUs	Certified Emission Reduction Units
CDM	Clean Development Mechanism
cm	Centimeter
COMESA	Common Market for East and Southern Africa
CERs	Certified Emission Reductions
C_T	Total carbon
C_F	Fraction of Carbon
$C_{stock\ total}$	Total carbon stock
C_{ag}	Above ground Carbon
$C_{bg\text{-}biom}$	Carbon in below ground biomass
C_{bg}	Below ground Carbon
C_{soil}	Carbon in the soil
CV	Co-efficient of Variation

DOEs	Designated Operational Entities
DNA	Designated National Authority
DPM	Decomposable Plant Material
D	Density
EPA	Environmental Protection Agency
EU	European Union
Evap	Evaporation
FYM	Farm Yard Manure
FAO	Food and Agricultural Organization of the United Nations
g	gram
GM	Green Manure
GMP	Green Manure Productivity
GHGs	Green House Gases
Ha	hectare
HUM	Humified Organic Matter
IOM	Inert Organic Matter
IPCC	Intergovernmental Panel for Climate change
Km	Kilometer
Kg	Kilogram
KSW	Kakira Sugar Works
Ltd	limited

LULUCF	Land Use, Land Use Change and Forestry
LUT	Land Use Type
MW	Mega watts
M	Meter
Max-SMD	Maximum Soil Moisture Deficit
M^3	Cubic Meter
NFA	National Forestry Authority
Ppp	Parts per million
PoA	Plan of Activities
PDDs	Project Design Documents
RPM	Resistant Plant Material
SOC	Soil Organic Carbon
SOM	Soil Organic Matter
Sq mi	Square mile
SMD	Soil Moisture Deficit
SOMNET	Soil Organic Matter Network
STDEV	Standard Deviation
t_c	tons of cane
Tc/ha	Tons of carbon per hectare
TSMD	Total Soil Moisture Deficit
USA	United States of America

Abstract

Soils, and managed agricultural soils in particular, represent a potentially significant low cost sink for greenhouse gases (GHGs) with multiple potential co-benefits to farm productivity and profitability (Jonathan, Ryan and Jeffrey, 2010). The great majority of agronomists and soil scientists agree that most agricultural soils can store more carbon and even a modest increase in carbon stocks across the large land areas used for agriculture would represent a significant GHG mitigation.

Sugarcane accompanied with good farming practices has the potential to sequester considerable amounts of carbon and so contribute to climate change mitigation. However, little has been done to provide relevant information concerning carbon sequestration in crop lands and sugarcane in particular. This research work focuses on finding out the ability of sugarcane to sequester carbon in the soil and involves analyzing four different sugarcane varieties among those grown by Kakira sugar works limited to assess their potential to sequester carbon. It is believed to provide the management of Kakira and other stakeholders the relevant information against which to base decisions for developing CDM projects to mitigate climate change through agriculture. Sugarcane grown in Kakira estates has the potential to sequester carbon between 589.11 to 591.12Tc/ha.

Therefore, with proper agronomic practices, carbon sequestration in sugarcane is a potential CDM project.

Key words: Carbon sequestration, sugarcane varieties, soil organic carbon, phytoliths, Bulk density

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Policy makers in Uganda, and many other nations, are currently debating how to design, implement and monitor carbon pollution reduction schemes (CPRS) as an important tool to reduce greenhouse gas emissions. Biospheric carbon offsets including soil carbon sequestration have the potential to be important components of any CPRS but numerous uncertainties still exist, especially within the agricultural sector, which are major barriers to effective policy implementation.

Soils, and managed agricultural soils in particular, represent a potentially significant low cost sink for greenhouse gases (GHGs) with multiple potential co-benefits to farm productivity and profitability (Jonathan, Ryan and Jeffrey, 2010, Lal 2004a; Pacala and Socolow, 2004). The great majority of agronomists and soil scientists agree that most agricultural soils can store more carbon and even a modest increase in carbon stocks across the large land areas used for agriculture would represent a significant GHG mitigation. However, currently, there is much uncertainty and debate, particularly within Australia, as to the total potential of soils to store additional carbon, the rate at which soils can store carbon, the permanence of this carbon sink, and how best to monitor changes in soil carbon stocks.

Throughout this research, I will primarily discuss the technical potential, defined by the biophysical conditions of the system, for agricultural land to store additional soil organic carbon (SOC) through improvements in management. It is very important to realize that this technical sequestration potential will likely never be fully realized due to a whole host of economic, social and political constraints

1.2 Soil carbon

Soil carbon sequestration is gaining global attention because of the growing need to offset the rapidly increasing atmospheric concentration of carbon dioxide (CO2). This carbon dioxide enrichment is associated with an increase in global warming potential and

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