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BUSITEMA UNIVERSITY ARAPAI CAMPUS

FACULTY OF AGRICULTURE AND ANIMAL SCIENCES

DEPARTMENT OF CROP PRODUCTION AND MANAGEMENT

EFFECT OF DIFFERENT RATES OF LIMING ON SOIL pH, P AND AGRONOMIC TRAITS OF COMMON BEANS IN EASTERN UGANDA

BY

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DECLARATION

I, IJARA JOSPHAT, declare that this research report is my own original work developed under the supervision of academic staff and that it has not been presented to any other University for a similar or any other degree award.

Date*:* ……

Signature: ……

APPROVAL

I confirm that the work reported in this thesis was carried out by the candidate under my supervision and has been submitted with my approval as university supervisor.

DR. JOHN WASIGE (ACADEMIC SUPERVISOR)

Date: 28/02/2024

Signature: .....

DEDICATION

This thesis is dedicated to my beloved Wife Awori Juliet Ijara and my daughter Amaal Leticia Ijara for being part of me during my academics journey.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of variance
GPS	Global positioning system
BUAC	Busitema University Arapai campus
$CaCO_3$	Calcium Carbonate
CEC	Cation exchange capacity
CRD	Completely randomized design
EAC	Eat African Community
FAO	Food and agriculture organization
FAOSTAT	Food and agriculture organization statistics
HRVA	Hazard risk and vulnerability Assessment
ISFM	Integrated soil fertility management
LR	Liming requirement
LE	Liming efficiency
MAAIF	Ministry of agriculture, animal industry and fisheries
NABE	NARO Beans
NARO	National agriculture research organization
NDP	National Development Plan
SBC	Soil Buffer capacity
SDGs	Sustainable development goals
SHF	Small holder farmers
SOM	Soil organic matter
SSA	Sub Saharan Africa

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ABSTRACT

Low soil pH and low soil available phosphorus, are major soil fertility problems with the soils under common bean production in East Africa. The major objective of this study was to develop a soil acidity management strategy for common beans production in Eastern Uganda by determining the effect of different rate of liming on soil pH, soil available P and agronomic traits of common beans. This was achieved through a laboratory-based incubation and a greenhouse experiment. The greenhouse trial used RCBD with four replications and ran for 70days while the incubation experiment used CRD with three replicates for 30 days. This was done out on acidic silty clay loam soils from Wera sub county Amuria district in E. Uganda. The data collected were subjected to analysis of variance (ANOVA), available P was analyzed using Bray 1 method. All the collected soil samples were acidic in reaction and pH varied from 4.89 to 6.69 with mean value of 5.612, available P was 3.2mg/kg with the textural class of silty clay loam (clay 35%, silt, 55% and sand 10%). Addition of $CaCO_3$ at different rates (0tons, 3tons, 4tons, 5tons, 6tons and 7tons/ha) to the soils significantly increased both pH and soil available P in the soil. Notably application of lime had significant effect on soil pH with the ($p<.001$) where 7tons/ha had the highest pH value of 6.69 and control had least value of 4.98. But liming at 6tons/ha met the liming requirement of the soils with 6.06 pH values. On the other hand, $CaCO_3$ also had a significant effect on the soil available P with ($p<.001$) where 7tons had the highest value 18.8mg/kg and control had the least with 4.1mg/kg of soil but 5 and 6tons raised the available soil P to 11mg/kg - 14.8mg/kg a range suitable for common beans (10-15mg/kg). Finally, there was a significant effect of all the treatments on the agronomic traits & 100 grain weight of beans with (plant height, leave number, tap root height, pod number and grain weight) having ($p<.001$) while branch number was not significantly affected ($p>.001$). Agronomically, application at 6tons/ha had the best performance compared to all the other application rates and it also showed the highest economic efficiency of 335.18% compared to other liming rates.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Globally, beans are the most important legume for human consumption. They are estimated to be the second most important source of dietary protein and the third most important source of calories. It is estimated that about 20 million tonnes are produced annually with a market value of $10 billion2 (FAOSTAT, 2012). The world's leading producers are India, Burma, Brazil, the United States, China, Mexico, Tanzania, and Uganda. In Africa, Uganda is second to Tanzania, according to 2018 United Nations Food and Agriculture Statistics.

Common bean is the most widely grown grain legume, and second only to maize as a food crop and a major source of food security in East Africa (Mauyo *et al*., 2007). Its consumption in the East Africa Community (EAC) has been increasing over years for the past decade. (FAOSTAT2018). Out of the 2.95 million tonnes consumed in the EAC during 2016, Uganda's bean consumption accounted for 32%, followed by Tanzania with 24.5%and Kenya with 17.2%. Rwanda and Burundi each accounted for about 13%. It is projected that by 2030, total demand for beans in the EAC will almost double due to growing populations, political stability, and sustained yearly economic growth of around 7%. These factors will increase the importance of beans as a staple and an affordable protein source across the region. (Team, 2020)

Common bean is an important legume staple crop in Uganda. The national annual consumption of beans is estimated at 58 kg per capita. In Uganda, Beans are among the government's 12 strategic priority crops under the National Development Plan 11 (2015/16 to 2019/20) for improving Smallholder Farmer living conditions

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