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FACULTY OF SCIENCE AND EDUCATION

DEPARTMENT OF CHEMISTRY

ASSESSING THE CORRELATION OF PHOSPHATE LEVELS IN SOIL AND VEGETABLE SAMPLES OF TOMATOES GROWN IN OSUKURU FARM IN TORORO DISTRICT

BY

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DECLARATION

I, CHEMUTAI SARAH, declare that this research project is my original work and has not been submitted to any other institution for academic credit.

Signature: ______________ **Date:** 26th/08/2026

APPROVAL

This research project has been submitted with the approval of the supervisor.

Signature: ______________ **Date:** 26/08/2026

SUPERVISOR'S NAME: DR. KAMOGA OMAR

DEDICATION

I dedicate this Project work to Ngokit Francisco.

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ABSTRACT

Phosphorus is an essential macronutrient required for plant growth and is commonly supplied through phosphate fertilizers to improve agricultural productivity (Brady, 2017). However, excessive fertilizer application can lead to phosphate accumulation in soils, environmental pollution, and altered nutrient uptake by crops (Correll, 1998). Despite the widespread cultivation of tomatoes in Osukuru Farm, Tororo District, Uganda, limited information exists on the relationship between phosphate concentrations in soil and tomato fruits. This study aimed to assess the correlation between phosphate levels in soil and tomato samples collected from Osukuru Farm. Specifically, the study determined phosphate concentrations in soil and tomato samples and established the relationship between the two. An experimental laboratory-based research design was employed. Composite soil and tomato samples were collected from five sampling sites, prepared using standard laboratory procedures, and analyzed using UV–Visible spectrophotometry based on the molybdenum blue method (Murphy, 1962). Standard phosphate solutions were used to generate a calibration curve, while phosphate concentrations were calculated from absorbance values. Pearson's correlation coefficient was used to determine the relationship between phosphate concentrations in soil and tomato samples. The results showed that phosphate concentrations in soil ranged from 1.090 g/kg to 1.755g/kg, while tomato samples contained lower concentrations ranging from 0.083 g/kg to 0.186 g/kg. The correlation coefficient curve indicated a very weak relationship between phosphate concentrations in soil and tomatoes, suggesting that soil phosphate levels had minimal influence on phosphate accumulation in tomato fruits. The study concluded that phosphate uptake by tomatoes is influenced by several factors beyond soil phosphate concentration, including soil properties and plant physiological processes (Raghothama, 1999). It recommends appropriate fertilizer application, routine soil testing, and improved soil management practices to enhance sustainable tomato production and environmental conservation (FAO., 2006).

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Phosphorus is one of the essential macronutrients required for plant growth and development. It plays a major role in energy transfer, photosynthesis, root development, flowering, fruiting, and maturation of crops (Brady, 2017). In agricultural systems, phosphorus commonly exists in the form of phosphate compounds in soil. The availability of phosphate in soil significantly influences the growth, yield, and nutritional quality of crops such as tomatoes (Havlin, 2014). Tomatoes are among the most widely cultivated vegetables in Uganda because of their nutritional value, economic importance, and high market demand (Jones, 2008).

In many agricultural areas, farmers apply phosphate-containing fertilizers to improve soil fertility and increase crop productivity (FAO., 2006). However, excessive or insufficient phosphate application may affect soil quality and influence the accumulation of phosphates in vegetables (Sharpley, 2003). High phosphate levels in agricultural soils may result from continuous fertilizer application, animal manure usage, irrigation practices, and environmental contamination (Troeh, 2005). When phosphate concentrations in soil become excessive, plants may absorb and accumulate abnormal amounts, which may affect vegetable quality and environmental sustainability (Correll, 1998).

Osukuru farm in Tororo District is one of the agricultural areas where tomato cultivation is widely practiced. Farmers in this region frequently use fertilizers to improve production due to continuous cultivation and declining soil fertility. Despite the extensive agricultural activities in the area, limited information exists regarding the relationship between phosphate concentrations in soil and tomatoes grown in the farms. Understanding this relationship is important because phosphate uptake by tomatoes depends on several factors including soil pH, organic matter content, soil texture, fertilizer application rates, and environmental conditions (Barber, 1995).

Assessment of phosphate levels in both soil and tomato samples provides important information about nutrient availability and nutrient transfer from soil to crops. Such information can help determine whether phosphate levels in tomatoes are directly influenced by soil phosphate concentrations. It can also help establish whether current fertilizer practices in Osukuru farm are environmentally safe and agriculturally effective (Brady, 2017).

Several analytical methods can be used to determine phosphate concentrations in environmental and vegetable samples. Among these methods, UV–Visible spectrophotometry using the molybdenum blue method is commonly used because of its accuracy, simplicity, sensitivity, and affordability (Murphy, 1962). In this method, phosphate ions react with ammonium molybdate under acidic conditions to form a phosphomolybdate complex, which is reduced to produce a blue-colored compound measured spectrophotometrically.

This study therefore intends to assess the correlation between phosphate levels in soil and tomato samples collected from Osukuru farm in Tororo District, Uganda. The findings may contribute to improved agricultural practices, proper fertilizer management, environmental monitoring, and protection of consumer health.

1.2 Problem Statement

Phosphorus is an essential nutrient required for plant growth and development and is commonly supplied through the application of fertilizers in agricultural systems. In vegetable production, farmers frequently apply phosphate-containing fertilizers to increase crop yield and improve productivity. However, excessive or improper fertilizer application may result in accumulation of phosphate in agricultural soils and edible plant tissues.

Elevated phosphate levels in soil can alter nutrient balance and contribute to environmental problems such as nutrient runoff and eutrophication of nearby water bodies. Accumulation of phosphate in vegetables may also indicate unsustainable fertilizer practices and potential environmental contamination. Tomatoes are among the widely cultivated and consumed vegetables in Uganda, yet information regarding phosphate levels in soils and vegetables grown in Ozukuru Farm, Tororo District, remains limited.

Despite increasing agricultural activities in the area, there is inadequate local data on phosphate concentrations in soils and vegetables produced at the farm. The absence of such information limits assessment of fertilizer use practices and environmental quality. Therefore, there is a need to determine phosphate levels in soil, tomato, and eggplant samples from s Farm using UV–

Visible spectrophotometry to provide baseline information for environmental monitoring and sustainable agricultural management.

1.3 Objectives

1.3.1 General Objectives

To assess the correlation between phosphate levels in soil and vegetable samples of tomatoes grown in ozukuru farm in tororo district

1.3.2 Specific Objectives

1. To determine the concentration of phosphates in soil samples collected from the tomato gardens in osukuru farm

2. To determine the concentration of phosphates in tomato samples collected in osukuru farm

3. To correlate between phosphate concentrations in soil and tomato sample

1.4 Research Questions

1. What are the concentration levels of phosphates in soil samples collected from the tomato gardens in osukuru farm

2. what are the concentration levels of phosphates in tomato samples collected in osukuru farm

3. what is the correlation between phosphate concentrations in soil and tomato sample

1.5 Justification of the Study

The study is important because tomatoes are widely consumed vegetables, and their quality is influenced by soil nutrient composition, particularly phosphate levels (Jones, 2008). Farmers in Osukuru farm frequently apply fertilizers to improve crop yield, yet limited information exists concerning the relationship between phosphate concentrations in soil and tomatoes grown in the area.

Assessing phosphate levels in soil and tomato samples will help determine whether phosphate accumulation in tomatoes is influenced by soil phosphate concentrations. The findings may help farmers adopt appropriate fertilizer application practices that improve crop productivity while minimizing environmental pollution and nutrient imbalance (Sharpley, 2003).

The study will also provide baseline scientific data for future researchers and agricultural authorities regarding phosphate distribution in agricultural soils and vegetables in Tororo

District. Additionally, the results may contribute to environmental protection and sustainable agricultural management by promoting proper use of phosphate fertilizers in tomato farming (Brady, 2017).

1.6 Significance of the Study

The study will provide important information on phosphate concentrations in soil and tomato samples collected from Osukuru farm. The findings may help farmers understand the influence of soil phosphate levels on tomato quality and nutrient accumulation.

The study may also guide agricultural extension workers and environmental authorities in promoting proper fertilizer management practices to prevent excessive phosphate accumulation in agricultural soils. The results can contribute to sustainable agricultural production and environmental conservation in Tororo District.

Researchers and students may use the findings as reference information for future studies related to soil nutrients, vegetable quality, and environmental monitoring. Additionally, the study may contribute to public awareness concerning the importance of maintaining appropriate phosphate levels in agricultural soils to ensure safe and quality vegetable production for consumers.

1.7 Scope of the Study

The study will focus on determining phosphate concentrations in soil and tomato samples collected from Osukuru farm in Tororo District, Uganda. Laboratory analysis will involve extraction and determination of phosphate levels using UV–Visible spectrophotometry. The study will specifically assess the relationship between phosphate concentrations in soil and tomatoes collected from selected gardens within the farm. The research will be limited to tomatoes grown during the study period and samples collected from the selected sampling sites.

CHAPTER TWO

2.0 LITERATURE REEVIEW

2.1 Importance and Use of Phosphates in Agriculture

Phosphates are essential nutrients required for plant growth and development. They play important roles in root formation, energy transfer, flowering, fruit development, and crop maturity (Brady, 2017). In agriculture, phosphate fertilizers are commonly applied to improve soil fertility and increase crop productivity. Common phosphate fertilizers include diammonium phosphate, single superphosphate, and triple superphosphate (FAO., 2006).

Tomato farming requires adequate phosphate supply because phosphorus improves root growth and fruit quality (Jones, 2008). In Uganda, farmers frequently apply phosphate fertilizers to increase tomato yields and maintain soil fertility (FAO., 2006). In Osukuru farm, fertilizers are commonly used because of continuous cultivation and increasing demand for tomatoes.

Although phosphates improve crop production, excessive application may result in accumulation of phosphates in soil (Troeh, 2005). High phosphate levels may affect soil nutrient balance and contribute to environmental pollution. Rainfall and irrigation may also cause movement of phosphates from agricultural fields into nearby water bodies (Correll, 1998). Therefore, proper phosphate management is important for sustainable agriculture and environmental protection.

2.2 Health and Environmental Impacts of Excess Phosphate Levels

Excess phosphate accumulation in the environment mainly results from continuous fertilizer application and poor nutrient management practices (Sharpley, 2003). One major environmental effect associated with excess phosphates is eutrophication. This occurs when phosphate-rich runoff enters rivers and lakes, stimulating excessive growth of algae and aquatic plants (Correll, 1998). Decomposition of these organisms reduces oxygen levels in water and affects aquatic life.

High phosphate concentrations in soil may also interfere with nutrient balance and influence crop quality (Brady, 2017). Although phosphates are less toxic compared to pesticides and heavy metals, excessive fertilizer use may contribute to environmental degradation and water contamination (Gupta, 2000).

Studies have shown that poor fertilizer management practices may reduce soil productivity and affect environmental sustainability (Troeh, 2005). Monitoring phosphate concentrations in agricultural soils and vegetables is therefore important for promoting safe farming practices and minimizing environmental pollution (FAO., 2006).

2.3 Phosphate Levels in Vegetables

Vegetables absorb phosphates from soil through their roots during growth and development. The concentration of phosphates in vegetables depends on soil phosphate levels, fertilizer application rates, soil pH, moisture content, and environmental conditions (Barber, 1995). Tomatoes require phosphorus nutrients for proper growth, fruit formation, and maturity (Jones, 2008).

Research studies have shown that vegetables grown in phosphate-rich soils may contain higher phosphate concentrations than those grown in nutrient-deficient soils (Raghothama, 1999). However, phosphate uptake by crops varies depending on soil conditions and farming practices (Barber, 1995). Some studies have reported positive relationships between soil phosphate concentrations and phosphate levels in vegetables (Marschner, 2012).

In Uganda, tomato farming has increased because of high demand for fresh vegetables. Farmers commonly use fertilizers to improve productivity, but limited information exists concerning phosphate concentrations in tomatoes grown in Osukuru farm. Determination of phosphate levels in tomatoes is important for assessing nutrient uptake and evaluating fertilizer management practices (Jones, 2008).

2.4 Analytical Methods Used in Determination of Phosphate Levels

Several analytical methods are used to determine phosphate concentrations in soil and vegetable samples. These methods include calorimetry, ion chromatography, and UV–Visible spectrophotometry (Agency., 2007). Among these techniques, UV–Visible spectrophotometry is widely used because it is simple, affordable, accurate, and suitable for routine laboratory analysis (Murphy, 1962).

The molybdenum blue method is commonly used for phosphate determination. In this method, phosphate ions react with ammonium molybdate under acidic conditions to form a phosphomolybdate complex. The complex is then reduced to produce a blue-colored solution measured using a UV–Visible spectrophotometer (Murphy, 1962).

Before analysis, soil samples are dried, ground, and sieved, while tomato samples are homogenized using a blender (Black, 1965). Appropriate extraction procedures are then used to release phosphates from the samples (Olsen, 1954). Standard phosphate solutions are prepared to generate calibration curves used in determining phosphate concentrations in unknown samples ((2007), 2007).

Correlation and regression analysis are used to establish the relationship between phosphate concentrations in soil and tomato samples. Accurate determination of phosphate levels is important for fertilizer management, agricultural productivity, and environmental conservation (Brady, 2017).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Research Design

This study used an experimental laboratory-based research design to investigate phosphate levels in soil and tomato samples collected from Osukuru farm in Tororo District, Uganda. The design involved collection of soil and tomato samples followed by laboratory extraction, determination, and quantification of phosphate concentrations using UV–Visible spectrophotometry.

The quantitative approach involved preparation of standard phosphate solutions, development of calibration curves, and measurement of absorbance of sample extracts using a UV–Visible spectrophotometer. Absorbance values obtained from the samples were compared with calibration curve values to determine phosphate concentrations in soil and tomato samples.

The experimental design is appropriate for determining phosphate concentration levels and establishing the correlation between phosphate concentrations in soil and tomato samples.

3.2 Study Area

This study was conducted in Osukuru farm in Tororo District, Uganda, and the chemistry laboratory. Osukuru farm served as the field site for collection of soil and tomato samples suspected to contain varying phosphate concentrations resulting from fertilizer application and agricultural activities.

After collection, samples were transported to the laboratory for analysis. Soil samples were prepared through air-drying, grinding, and sieving, while tomato samples were washed, chopped, and homogenized. Extraction of phosphate compounds were carried out using suitable extraction procedures for phosphate determination.

The extracted samples were subjected to quantitative analysis using UV–Visible spectrophotometry for determination and quantification of phosphate concentrations under controlled laboratory conditions.

3.3 Materials

3.3.1 Apparatus

UV–Visible spectrophotometer, Analytical balance, Mechanical shaker, Blender/homogenizer Water bath, Mortar and pestle, Conical flasks (250 mL), Volumetric flasks (50, 100, 1000 mL), Beakers, Measuring cylinders, Funnels, Pipettes and micropipettes, Test tubes, Test tube rack, Glass stirring rods, Whatman No.1 filter paper, Polyethylene sample bags, Soil auger, and Sieve (2 mm)

3.3.2 Chemicals and Reagents

Potassium dihydrogen phosphate (KH_2PO_4), Sodium bicarbonate ($NaHCO_3$), Ammonium molybdate, concentrated sulfuric acid (H_2SO_4), Ascorbic acid, and Distilled water

3.4 Sample Collection

Composite soil samples were collected randomly from different sections of the farm at a depth of 0–15 cm using a soil auger. Samples from several points were mixed thoroughly to obtain representative samples and transferred into labeled polyethylene bags**.**

3.4.1 Vegetable samples

Fresh tomato and eggplant samples were collected randomly from different locations within the farm and transported to the laboratory in labeled bags.

3.5 Preparation of the different reagents

3.5.1 Sodium bicarbonate solution

0.5M solution of sodium bicarbonate was prepared by dissolving 42g of sodium bicarbonate in 1000ml of distilled water.

3.5.2 Ammonium molybdate.

10% ammonium molybdate was prepared by dissolving 10g of ammonium molybdate in 100ml of distilled water.

5% of ascorbic acid solution was prepared by dissolving 2.5g in 50ml of distilled water.

3.5.3 Preparation of phosphate standard solution

0.2197g of potassium dihydrogen phosphate was weighed using analytical balance and dissolved in 1000ml of distilled water producing 50mg/l phosphate solution. The reference standards were prepared by diluting the different proportions of the phosphate stock solution to 100ml using distilled water as below

3.5.4 Preparation of working standard solutions

The working standard phosphate solutions were prepared by transferring 0, 1 ,4, 8, 12, and 16mL of the phosphate stock solution into separate 100mLvolumetric flasks. Each solution was then diluted to the 100mLmark with distilled water to obtain phosphate concentrations of 0, 0.5, 2.0, 4.0, 6.0, and 8.0mg/L, respectively. The prepared standards were used in constructing calibration curve for phosphate determination.

3.5.5 Calibration

50ml of distilled water was measured and placed in a clean flask.

2ml of concentrated sulfuric acid solution was added followed by 2ml of ammonium molybdate reagent and then three drops of ascorbic acid were added

The prepared solution was allowed to stand for 10 minutes to develop the blue color

The resultant solution was transferred into a clean cuvette and then zero the UV- Visible spectrophotometer at a wave length of 660nm

The above procedures were repeated for the different reference standards and their absorbance were determined using the UV-visible spectrophotometer.

The calibration curve was plotted (absorbance vs concentration)

3.6 Sample Preparation

3.6.1 Soil samples

The soil sample was air-dried at room temperature.

Stones, roots, and debris were removed from the soil sample.

The soil sample was then ground with mortar and pestle.

The soil sample was sieved using a 2 mm sieve.

The sample was stored in labeled containers.

3.6.2 Tomato samples

The tomatoes were washed with distilled water to remove dust and then cut into small pieces.

The samples were then homogenized using a blender.

3.7 Sample Analysis

3.7.1 For soil sample

Procedure for phosphate extraction from the soil

2.0g of the soil sample was weighed using an analytical balance and was transferred into a clean 100ml conical flask.

40ml of 0.5M sodium bicarbonate was added into the flask containing the soil sample to extract the phosphates.

The flask was covered properly using a stopper and was Shaked vigorously for 30 minutes to ensure complete extraction of phosphate ions from the soil

Then the mixture was filtered carefully using a filter paper.

The filtrate was collected into a clean labelled container.

3.7.2 Determination of concentration of phosphates in soil sample

Procedure

10ml of the soil extract was pipetted into a 50ml volumetric flask

2ml of concentrated sulfuric acid solution was added followed by 2ml of ammonium molybdate reagent and then three drops of ascorbic acid was added

The prepared solution was allowed to stand for 10 minutes to develop the blue color

The resultant solution was transferred into a clean cuvette and its absorbance was measured using UV- Visible spectrophotometer at a wave length of 660nm.

The concentration of phosphates in the soil sample were obtained using the standard curve

3.7.3 For tomato sample

5.0 g of each homogenized tomato sample was accurately weighed and then transferred into a clean conical flask.

50 mL distilled water was added

The mixture was shaken thoroughly for 20 minutes using a vortex machine.

The mixture was filtered through Whatman No.1 filter paper.

The filtrate was collected in a well labelled container.

3.7.4 Determination of concentration of phosphates in the tomato filtrate.

Procedures

10ml of the tomato filtrate was pipetted into a clean 50ml volumetric flask

2ml of concentrated sulfuric acid solution was added followed by 2ml of ammonium molybdate reagent and then three drops of ascorbic acid was added

The prepared solution was allowed to stand for 10 minutes to develop the blue color

The resultant solution was transferred into a clean cuvette and its absorbance was measured using UV- Visible spectrophotometer at a wave length of 660nm.

The concentration of the phosphates in the tomato and soil sample was calculated by using the standard equation

Y=mx + C where

$$X = \frac{Y - C}{m}$$

Y is the absorbance

X is the concentration

C is the y-intercept

And m is the gradient of the straight line

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results obtained from the determination of phosphate concentrations in soil and tomato samples collected from the five sampling sites in osukuru farm. The phosphate concentrations were determined using UV-visible spectrophotometry after preparing a calibration curve from standard phosphate solutions.

4.2 presentation of results

4.2.1 calibration curve for phosphate standards

A calibration curve was prepared using phosphate standard solutions with concentrations of 0, 0.5, 2, 4, 6 and 8mg/L.

The corresponding absorbance values were measured using a UV-visible spectrophotometer at a wave length of 660nm. A graph of absorbance against phosphate concentration produced a straight-line calibration curve, which was used to determine phosphate concentrations in the unknown soil and tomato sample extracts.

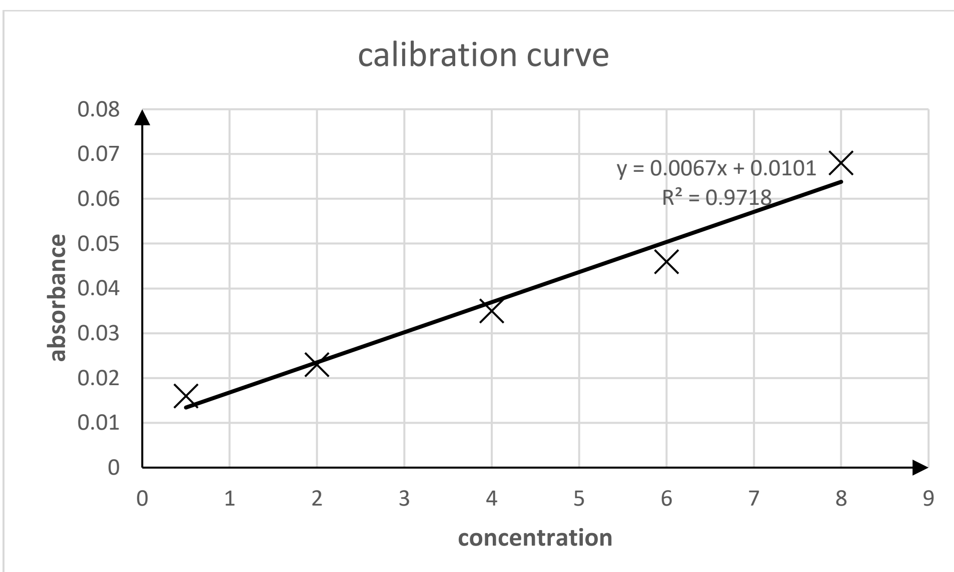

Figure 1: showing calibration curve

4.2.2 Phosphate concentrations of soil samples and tomato samples

The phosphate concentrations determined in soil samples and tomato samples collected from the five sampling sites are presented in table 4.1

Table 1: Showing Phosphate concentrations of soil samples and tomato samples

Sampling site	Concentration in soil (g/kg)	Concentration in tomato (g/kg)
Site 1	1.339	0.083
Site 2	1.755	0.140
Site 3	1.090	0.118
Site 4	1.307	0.186
Site 5	1.503	0.092

The results show that phosphate concentration in soil ranged from 1.090g/kg to 1.755 g/kg. Site 2 recorded the highest phosphate concentration (1.755 g/kg), while site 3 recorded the lowest concentration (1.090 g/kg). The variation in phosphate concentrations among the

Sampling sites suggests differences in fertilizer application, soil difference, soil characteristics and management practices.

The phosphate concentrations in tomato samples ranged from 0.083g/kg to 0.186g/kg. Site 4 had the highest phosphate concentrations (0.186g/kg), whereas site 1 had the lowest concentration (0.083g/kg). Overall, phosphate concentration in tomato samples were much lower than those found in the corresponding soil samples.

4.2.3 Correlation coefficient curve between phosphate concentrations in soil and tomato samples

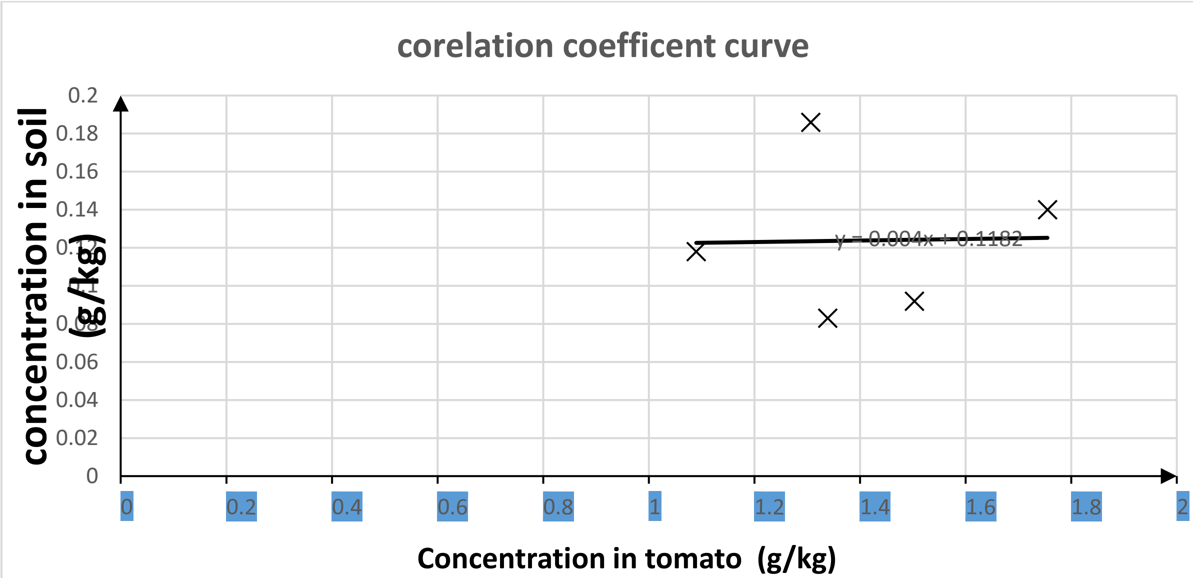

Figure 2: Showing Correlation coefficient curve.

The correlation coefficient curve was used to determine the relation between phosphate concentration in soil and tomato samples. The correlation coefficient curve shows a very weak relationship between phosphate concentration in soil and tomato samples.

The correlation coefficient curve indicates a very weak relationship between phosphate concentration in soil and tomato samples, suggesting that soil phosphate concentration had little influence on phosphate accumulation in tomatoes.

4.3 Analysis of Findings

4.3.1 Analysis of Phosphate Concentrations in Soil Samples

The results indicate that phosphate concentrations differed among the five sampling sites. The highest concentration was observed at Site 2, while the lowest concentration was recorded at Site 3. These differences may be attributed to variations in fertilizer application rates, soil fertility, cropping history, and other environmental factors. Despite these variations, all the sampled sites contained measurable amounts of phosphate, indicating that phosphate was available in the soils used for tomato production.

4.3.2 Analysis of Phosphate Concentrations in Tomato Samples
Tomato samples contained lower phosphate concentrations than the corresponding soil samples. This suggests that only a portion of the phosphate present in the soil was absorbed by the tomato plants. The variation in phosphate concentration among tomato samples may be explained by differences in plant growth stage, root development, soil moisture, and phosphate availability.

4.3.3 Analysis of the Correlation Between Soil and Tomato Phosphate Concentrations
The correlation coefficient curve indicate an almost negligible relationship between phosphate concentrations in soil and tomato samples. This suggests that increasing phosphate concentration in soil does not necessarily result in increased phosphate accumulation in tomatoes. Other factors such as soil pH, organic matter content, microbial activity, and plant physiological processes are likely to influence phosphate uptake.

4.4 Discussion of Results
4.4.1 Discussion of Phosphate Concentrations in Soil Samples
The relatively high phosphate concentrations observed in the soil samples indicate that the soils contained adequate phosphate for crop production. This may be attributed to the regular application of phosphate fertilizers by farmers in Osukuru Farm. However, not all phosphate present in the soil is available for plant uptake because some phosphate becomes fixed by calcium, iron, or aluminum compounds depending on soil conditions.

4.4.2 Discussion of Phosphate Concentrations in Tomato Samples
The phosphate concentrations observed in tomato samples were much lower than those found in the soil samples. This finding indicates that tomato plants absorbed only part of the phosphate available in the soil. Phosphate uptake by plants depends on several factors, including soil pH, moisture content, root development, microbial activity, and the availability of soluble phosphate ions. Therefore, high phosphate concentration in soil does not necessarily result in high phosphate concentration in tomato fruits.

4.4.3 Discussion of the Correlation Between Soil and Tomato Phosphate Concentrations
The very weak relationship observed in the correlation curve indicates that soil phosphate concentration had minimal influence on phosphate accumulation in tomatoes. This finding suggests that phosphate uptake is controlled by several interacting environmental and physiological factors rather than soil phosphate concentration alone. Therefore, improving

phosphate uptake in tomatoes requires proper soil management practices in addition to appropriate fertilizer application.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study successfully determined the phosphate concentrations in soil and tomato samples collected from five sampling sites in Osukuru Farm using UV-Visible spectrophotometry. The results showed that phosphate concentrations in soil ranged from 1.090 g/kg to 1.755 g/kg, while phosphate concentrations in tomato samples ranged from 0.083 g/kg to 0.186 g/kg. The soil samples consistently contained higher phosphate concentrations than the tomato samples, indicating that only a portion of the phosphate available in the soil was absorbed and accumulated by the tomato plants.

The study further established from the correlation coefficient curve that there was a very weak relation between phosphate concentrations in soil and tomato samples. This finding indicates that soil phosphate concentration alone had minimal influence on phosphate accumulation in tomatoes. Therefore, phosphate uptake by tomato plants is likely influenced by other factors such as soil pH, soil moisture, organic matter content, microbial activity, root development, and fertilizer management practices.

Overall, the findings demonstrate that although phosphate is present in the soils of Osukuru Farm, its concentration in the soil does not directly determine the phosphate content of tomato fruits. Proper soil management and appropriate fertilizer application are therefore essential for improving phosphate availability and uptake by tomato plants.

5.2 Recommendations

Based on the findings of this study, the following recommendations were made:

Farmers should apply phosphate fertilizers according to recommended agricultural practices to ensure efficient utilization of nutrients and avoid excessive phosphate accumulation in soils.

Soil testing should be carried out before fertilizer application to determine the nutrient status of the soil and guide appropriate fertilizer recommendations.

Farmers should adopt proper soil management practices, such as maintaining suitable soil pH and increasing organic matter, to improve phosphate availability to tomato plants.

Agricultural extension officers should provide continuous training to farmers on appropriate fertilizer application methods and sustainable nutrient management practices.

Government and agricultural stakeholders should encourage routine monitoring of soil nutrients in farming areas to promote sustainable crop production and protect the environment.

5.3 Areas for Further Research

The following areas were recommended for future research:

I. Investigate the influence of soil pH on phosphate availability and uptake in tomato plants.
II. Evaluate the effects of different phosphate fertilizer application rates on tomato growth, yield, and phosphate accumulation.
III. Assess the relationship between phosphate and other essential nutrients such as nitrogen and potassium in tomato production.
IV. Conduct similar studies in other tomato-growing regions of Uganda to compare phosphate levels and nutrient uptake under different environmental conditions.
V. Investigate the seasonal variation of phosphate concentrations in soils and tomatoes to determine how environmental conditions influence phosphate uptake.

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