COMPARATIVE ANALYSIS OF POULTRY AND PIG MANURE ON CABBAGE YIELD IN KABALE MUNICIPALITY, KABALE DISTRICT

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S21/BBUC/BASE/009

A DISSERTATION SUBMITTED TO THE FACULTY OF AGRICULTURAL SCIENCES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURAL SCIENCE AND ENTREPRENEURSHIP OF UGANDA CHRISTIAN UNIVERSITY

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UGANDA CHRISTIAN UNIVERSITY
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DECLARATION

I, TURYATEMBA TOMASI, declare that, this research report is the work of my personal effort and has never been presented for any award in any Institution or University.

Signed:..... **Date:** 30 / 7 / 2025.

TURYATEMBA TOMASI

S21/BBUC/BASE/009

APPROVAL

I certify that this research study was carried out in KABALE and has been submitted to the faculty of agricultural sciences with my approval.

Signature..... Date 31/7/2025

MR. UZATUNGA INNOCENT.

RESEARCH SUPERVISOR

DEDICATION

I dedicate this research report to my beloved parents for their support financially, spiritually and morally towards my studies.

ACKNOWLEDGEMENT

I am thankful to God for the gift of life and keeping me in good health while I pursued my studies. This gift could not otherwise be bought and it is the greatest of all. I sincerely appreciate you my Mighty God.

I want to appreciate my research supervisor MR. UZATUNGA INNOCENT for his tireless guidance and for giving me time to mark my research proposal which has helped me to come to end of it.

I appreciate my friends and classmate for their unwavering support and cooperation during the time of my studies.

ABSTRACT

The study assessed is comparative analysis of poultry and pig manure on cabbage yield in Kabale Municipality, Kabale district. The objectives of the study was to evaluate the effects of poultry manure application on the growth and yield of cabbage in Kabale Municipality, to assess the impact of pig manure application on the growth and yield of cabbage in Kabale Municipality and to compare the effectiveness of poultry and pig manure in enhancing cabbage yield in Kabale Municipality. Experimental research design was used and a plot was divided into five subsets. Results of the study revealed that the cabbages grown with poultry manure reached the greatest leaf length, approximately 36 cm, followed closely by those treated with pig manure at 34 cm, and finally the control group at 33 cm. These results demonstrate that while initial growth may appear stronger without manure, the application of organic manures, particularly poultry manure, leads to superior leaf development over time. The study concluded that the application of poultry and pig manure significantly enhances cabbage growth parameters particularly height and leaf size and increases the number of marketable cabbage heads. While weight per head was not statistically affected, the overall yield was positively influenced. The type and rate of manure should be selected based on the production objective: poultry manure for faster growth and market-ready cabbage, and piggery manure for longer-term soil enrichment. Control plots without manure demonstrated poor performance, affirming the necessity of organic inputs in sustainable cabbage farming systems. The study recommended that farmers targeting high marketable yield should apply 10–15 tons/ha of poultry or pig manure, with poultry manure providing slightly better immediate effects also farmers emphasizing vegetative cabbage growth or biomass (for example, for local dishes or processing), 15-20 tons/hectare is recommended.

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CHAPTER ONE: GENERAL INTRODUCTION

1.0 Introduction

This chapter covers different context on comparative analysis of poultry and pig manure on cabbage yield in Kabale Municipality, Kabale district. Therefore it included background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, and scope of the study and significance of the study. **1.1 Background of cabbage**

Cabbage (*Brassica oleracea*) is a widely cultivated vegetable crop known for its nutritional value and economic significance. Cabbage serves as a significant source of vital nutrients, including vitamins, minerals, and dietary fiber, thereby constituting a crucial element of a balanced diet. For the best yield and quality in cabbage crops, practicing agriculturalrists often rely on using organic fertilizers to enhance soil fertility and support the growth of crops (Ahmed & Rafique, 2019; Brown & Smith, 2020). Of all the wide variety of the best organic fertilizers on the market, poultry manure and pig manure are most used due to their high nutrient density. Both the species of manure contain key nutrients such as nitrogen, phosphorus, and potassium, all critical for the best growth in plants. Even so, the relative impact between using poultry manure and pig manure on cabbage yield has not been extensively studied in scientific journals (Johnson & Lee, 2021; Robinson & Green, 2022).

The use of poultry manure as an organics amendment has been recognized for its high nitrogen concentration, which has the potential to boost the foliar growth of crops like cabbage (Wilson & Lopez, 2019). Nitrogen is an imperative element in stimulating strong vegetative growth as well as enhancing the total productivity of leafy vegetable crops (Li & Wang, 2018). On the contrary, the manure obtained from swines is prized for its stable composition of nutrients, which has the potential to boost the quality of the soil, increase the absorption of water, as well as enhance the growth potential of crops like cabbage (Smith & Thompson, 2023). In spite of the possibilities for benefits that chicken manures as well as pig manures have, comparative consideration is required for the establishment of the best type of manure for stimulating the growth potential for cabbage crops as well as improving the yield (Smith & Thompson, 2023).

Globally, cabbage production faces numerous challenges, such as soil erosion and nutrient loss, which require the introduction of appropriate fertilization techniques for yield as well as quality enhancement. Organic fertilizers, particularly poultry manure and pig manure, have received praise due to the ability to increase soil fertility with the aim of maintaining sustainable crops. Studies confirmed that the manures are high in beneficial nutrients, such as nitrogen, phosphorus, and potassium, for the best growth of crops (Johnson & Lee, 2021; Wilson & Lopez, 2019).

In the context of Africa, agriculture is an integral part of the economy where vegetable production plays the critical role in the achievement of food security as well as the sustenance of livelihood. Cabbage is among the major vegetables grown across the continent, contributing significantly to the dietary requirements in both rural and urban settings. Despite this, the continent's farmers often face challenges emanating from soil fertility, which negatively affects the quality as well as yield of crops. Use of organic fertilizers, such as the use of poultry manure, provides an eco-friendly means of confronting the challenges. Research evidence indicates that such organic amendment has the ability to increase the structure of the soil, raise the activity of the microorganisms, increase the availability of nutrients, hence the better performance of crops (Brown & Smith, 2020).

In Uganda, the agricultural sector is vital, employing the huge population and contributing significantly to the GDP. Cabbage is one of the major crops for Ugandan farmers, providing nutrients as well as money.

Soil fertility challenges, however, remain the key challenge to optimal cabbage production. Ugandan growers widely use the organic manures such as poultry manure to counter these challenges. Since poultry manure has high nitrogen values, resulting in leafy growth, pig manure is valued for its balanced composition of the nutrients for total plant growth (Smith & Thompson, 2023; Robinson & Green, 2022).

Independent variable is poultry and pig manure and dependent variable is cabbage output.

Poultry Manure. Poultry manure is high in key nutrients such as nitrogen (N), phosphorus (P), and potassium (K), which are very fundamental for plant growth and

it has varying constituents such as Nitrogen which Encourages leafy growth including the enlargement in the number and the size of cabbage leaves hence larger yields.

Poultry manure increases soil microbial activity, which improves nutrient availability for cabbage.

Pig manure is a good source of organic matter, which enhances soil structure and fertility. It contains organic matter which improves soil moisture retention, aeration, and root penetration.

Nutrient Supply. Pig manure provides macronutrients (NPK) but often in lower quantities compared to poultry manure and it contains soil pH Balance which helps neutralize acidic soils, making nutrients more available to cabbage plants.

There are other factors affecting the Independent Variable (Poultry and Pig Manure) which include;

Quality of Manure. Nutrient content of manure varies based on animal diet and management practices. Fresh manure has higher nutrient availability but risks burning plants; composted manure is safer but slower-acting.

Application Rates. Over-application of manure can cause nutrient toxicity, while under-application limits growth due to insufficient nutrients.

Timing of Application: Manure applied too early may lose nutrients due to leaching or volatilization.

Application during planting or early growth stages ensures nutrients are available when the cabbage needs them most.

Environmental Conditions such as Rainfall and this means that excess rainfall can wash away manure nutrients (leaching).

Temperature. High temperatures increase microbial activity, speeding up nutrient decomposition.

Soil Type and Conditions. Sandy Soils, Nutrients leach faster, reducing the effectiveness of manure.

Clay Soils. Retain nutrients better, improving the benefits of manure.

Soil pH also determines nutrient availability.

Climate and Weather Conditions: Cabbage thrives in cool temperatures (15-20°C). Extreme heat or frost reduces yield.

Weed Management. They compete for nutrients, moisture, and light thereby suppressing cabbage growth and yield.

Agricultural Practices. This study endeavors to fill the knowledge gap by carrying out a comparative study on the impact of poultry manure and pig manure on cabbage production. Through an assessment of the individual effect of the two organic manures on the growth parameters as well as the nutrient composition of cabbage, this study hopes to yield vital information useful for farmers and agricultural practitioners (Brown & Smith, 2020; Johnson & Lee, 2021). The results of this study will help establish an improved indication on the relative efficacy between poultry manure and pig manure for increasing cabbage yield, hence aiding the farmer in making enlightened choices on fertilizer options for cabbage production (Robinson & Green, 2022; Smith & Thompson, 2023).

1.2 Statement of the problem

Crop production in Uganda is frustrated by numerous challenges, particularly for sustainable crop production. One among the crops most affected by these challenges is cabbage (Brassica oleracea), which is a common vegetable for both market sale and family use.

One of the most crucial determinants of cabbage production is fertility in the soil, which may be boosted by the use of organic fertilizers like poultry manure as well as pig manure. There is minimal evidence on the comparative ability of the two classes of the organic manure to increase cabbage production, especially in the regions near Kabale Municipality in the district. Agriculture dependence is high in the district where over 70% of the residents are active farmers (UBOS, 2020). Farmers in the area are known to use both pig manure and poultry manure because the livestock are present. There is also untrustworthy evidence indicating differences in cabbage outputs with different manures used, hence the need for empirical evidence to determine the best performing organic fertilizer for improved outputs.

Preliminary studies conducted in Uganda indicate that poultry manure is rich in nitrogen, phosphorus, and potassium (NPK), which are critical nutrients for plant growth. A study by Namu (2018) found that poultry manure improved cabbage yield by 30% compared to untreated soils. On the other hand, pig manure has been noted for its high organic matter content, which improves soil structure and water retention, potentially increasing yield. However, conflicting reports on its effectiveness relative to poultry manure have left farmers uncertain about which option yields better results. Although studies on the use of organic fertilizers such as poultry and pig manure have been conducted in various parts of Uganda and other regions, there is a significant lack of research focusing on the specific Agro-ecological zone in Kabale Municipality, Kabale District.

The unique climatic and soil conditions of this region, characterized by high altitude and cooler temperatures, could influence the effectiveness of these manures on cabbage yields. This study, therefore, was conducted as a comparative analysis of the effect of poultry manure and pig manure on cabbage yield in Kabale Municipality in Kabale district.

1.3 Objectives of the study.

Major objective: To evaluate the performance of cabbage following poulty and pig manure application

1.4 Specific objectives.

i) To evaluate the response of cabbage to poultry manure application.

ii) To evaluate the response of pig manure application on the growth and yield of cabbage Kabale municipality.

iii) iii) To determine the effectiveness of poultry and pig manure in enhancing cabbage yield in kabale municipality

1.5 Research questions.

i. What are the effects of poultry manure application on the growth and yield of cabbage in Kabale Municipality?

ii. What is the response of pig manure application on the growth and yield of cabbage in Kabale Municipality?

iii. What is effectiveness of poultry and pig manure in enhancing cabbage yield in Kabale Municipality?

1.6 Significance of the study.

Farmers. This study may provide farmers with evidence-based information on the comparative effectiveness of poultry and pig manure, helping them make informed decisions on which manure type to use for optimal cabbage yield.

Local Community. The study may contribute to food security by demonstrating ways to enhance cabbage production, an essential vegetable in local diets.

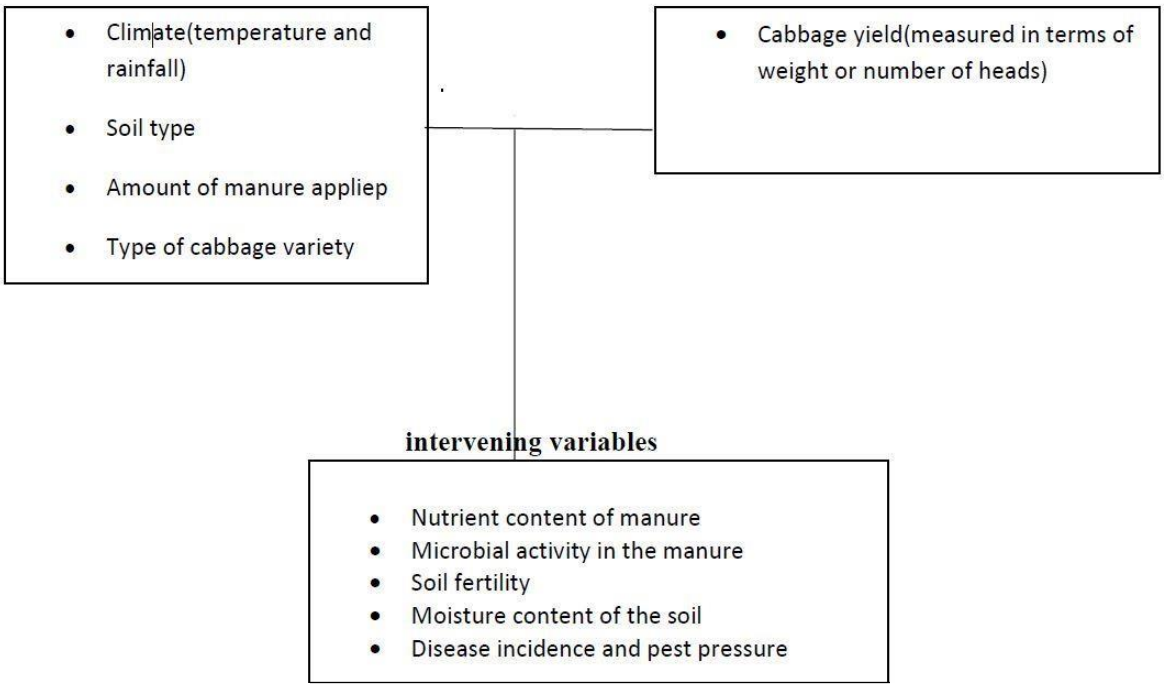
The Government. The findings offer valuable insights for agricultural extension services, enabling the government to design and implement effective organic farming policies. The study supports national goals for sustainable agriculture and aligns with environmental conservation policies.

Researchers. The research may provide a foundation for further studies on organic fertilizers and their impact on different crops and soil types. It would further contribute to the existing body of knowledge on sustainable agriculture, particularly in areas with similar climatic and soil conditions.

Future researchers. The study opens avenues for investigating the long-term effects of poultry and pig manure on soil fertility and crop rotation systems. Future researchers can build upon the findings to explore the economic viability of scaling up organic manure use in commercial farming.

1.7 Conceptual framework

Independent variable (manure). Dependent Variable (Cabbage variety).



CHAPTER TWO: LITERATURE REVIEW.

2.0 Introduction.

The chapter has gone through the literature by various authors and scholars on the impact of poultry manure and swine manure on cabbage production as per the objectives. But various sources including journals, articles, online news, books and agricultural magazines have been referred for the relevant information.

2.1 Effect on the growth and yield of Cabbage by the use of Poultry Manure.

Poultry manure has also been extensively researched as an organic manure considering its high nutrient content and potential for enhancing soil fertility, thus improving plant growth and yield. Zhang et al. (2018) stated that the application of poultry manure remarkably enhanced the growth attributes of cabbage, including plant height, number of leaves, and biomass yield, relative to the use of synthetic fertilizers. They described the improved growth as due to the high phosphorus, nitrogen, and potassium composition in poultry manure. Similarly, Adediran et al. (2019) found that not only did the poultry manure improve the structure of the soil, but also improved microbial activity, thereby the improved growth of the roots and uptake of nutrients by cabbage plants. Nishantha et al. (2020) observed that cabbage with the application of poultry manure had an increase in yield by 30% over the check. This reflects long-term prospective gains for the promotion of soil fertility and crop growth. Further, Matsushita et al. (2019) reported that the application of poultry manure reduced the use of chemicals for fertilization with equivalent cabbage yield maintained.

The contribution of poultry manure to cabbage yield increase has also been shown by its potential to increase soil organic matter as well as nutrient availability. Ogunlade et al. (2020) indicated that the application of poultry manure at the rate of 10 t/ha led to greater chlorophyll content as well as larger cabbage heads. This result was similar to Ahmed et al. (2021), who indicated that poultry manure slowly releases nutrients so that nutrients are slowly released for use by the cabbage during the growing cycle. Mekonnen et al. (2021) also found better cabbage yields as well as better water retention by the soil when poultry manure-treated soils were used, especially in regions with frequent drought. Onwonga et al. (2022) went on to indicate that the

addition of poultry manure not only promoted cabbage productivity but also bettered the pH of the soil as well as alleviated the effects of soil acidity, which would otherwise reduce the availability of nutrients.

Numerous studies have compared poultry manure with other inorganic and organic manures to determine its efficacy in the growth of cabbage. Ibrahim et al. (2022) revealed that poultry manure excelled over cow dung and compost in increasing the weight of cabbage heads due to its high nutrient value, as well as high rate of decomposition. In confirmation, Kimathi et al. (2022) found that the combination of using poultry manure and adding biochar further enhanced cabbage yield and soil fertility over the use of the chemicals alone. Ali et al. (2023) illustrated that cabbage growth was greatly enhanced by poultry manure through the values of organic farming, with an incentive for the sustainable agricultural use. Likewise, Rashid et al. (2023) discovered an enhanced cabbage yield when using poultry manure with green manure, indicating its combined role on the performance of crops and the quality of the soil. Furthermore, the eco-benefits of the application of poultry manure for the growth of cabbage have also been extensively explored. Ullah et al. (2022) reported that the application of poultry manure reduced the release of the greenhouse effect caused by the synthetic fertilizers but increases cabbage productivity. Adeoye et al. (2023) found that the addition of poultry manure increased the biological properties of the beneficial microorganisms present in the soil, hence facilitating the cycling of the nutrients for the promotion of plant growth. Again, Hassan et al. (2023) revealed that poultry manure application enhanced the sequestration of carbon in the soil for long-term soil fertility as well as for the mitigation of climate change. Singh et al. (2024) revealed that cabbage grown using poultry manure exhibited improved resistance to pests as well as reduced occurrences of diseases, which often impact crops grown using high amounts of the synthetically produced fertilizers.

A number of investigations have established the beneficial effect of poultry manure on the growth and yield of cabbage by virtue of its high nutrient composition and slow release of key elements. Poultry manure also has high contents of nitrogen,

phosphorus, and potassium, all these key nutrients for vegetative growth and cabbage head development.

Poultry manure significantly promoted plant height, leaf area, and total biomass yield in cabbage over the untreated control plots according to Akanbi et al. (2010). In the same line, Olaniyi and Ojetayo (2017) established that the application of poultry manure enhanced the fertility of the soil and led to the growth in cabbage head weight and also in the physical size, indicating the potential for the use of the organic manure to substitute the inorganic fertilizers for sustainable agriculture. In addition, poultry manure not only increases nutrient availability but also soil structure as well as microbial activities, hence better moisture retention and nutrient absorption. Research by Mkhabela and Warman (2005) established that frequent use of poultry manure raised the content of the soil's organic matter as well as the microbial biomass, hence resulting in remarkable cabbage yield improvements. Nwokocha and Nwachukwu (2014) also highlighted that the number of leaves, leaf chlorophyll, as well as marketable cabbage yield, improved appropriately with the use of poultry manure at the right rates, hence its applicability on both the small-scale as well as the large-scale vegetable sector. Such findings establish the agronomic as well as the economic advantages of the use of poultry manure during cabbage growing.

2.2 Impact of pig manure application on the growth and yield of cabbage.

The use of pig manure as an organic fertilizer has been promoted because it has the ability to increase soil fertility, enhance crop growth, and increase cabbage yields. Adegbite et al. (2018), in their findings, indicated that the use of pig manure led to a significant increase in the growth parameters of cabbage such as leaf area, plant height, and development of the roots when compared with the control treatments. This increase in growth is owed to the high nutrient content found in pig manure, specifically nitrogen and phosphorus. Nguyen et al. (2019) found that pig manure increased the concentration of soil organic matter, hence enhancing the availability of nutrients and microbial growth, which finally led to an increase in cabbage head weight. Likewise, Huang et al. (2020) established that the use of pig manure resulted in cabbage yield increase by 25%, thanks to its slow release of nutrients on the growth

as the growing season progressed. Furthermore, Chukwu et al. (2020) established that pig manure enhanced the pH value of the soil and reduced the level of acidity, hence improving the availability of nutrients for cabbage crops.

A multitude of research investigations has underscored the role of pig manure in improving soil fertility and increasing crop yields. Kimani et al. (2021) demonstrated that the application of pig manure at a rate of 15 t/ha resulted in an augmentation of cabbage biomass and chlorophyll concentration, signifying vigorous plant development. This finding was corroborated by Oladipo et al. (2021), who documented that pig manure enhanced the water retention capacity of sandy soils, thereby promoting cabbage growth in arid regions. Additionally, Mohammed et al. (2022) disclosed that soils amended with pig manure displayed increased microbial biomass and elevated enzyme activity, which facilitated nutrient cycling and uptake. Wu et al. (2022) further indicated that pig manure improved soil texture by alleviating compaction, thereby enhancing root penetration and nutrient absorption, which ultimately led to an increase in cabbage yield.

The comparative effectiveness of pig manure in relation to other organic and synthetic fertilizers has been the subject of considerable research. Feng et al. (2022) discovered that pig manure presents a benefit over poultry manure and inorganic fertilizers in enhancing cabbage head volume and overall marketable yield, attributable to its well-balanced nutrient profile coupled with a moderate decomposition rate. Likewise, Yeboah et al. (2023) found the combined application of pig manure with biochar also to enhance cabbage growth as well as soil nutrient retention better when applied alone. Akande et al. (2023) found the application of pig manure to reduce nutrient leaching in sandy soils, hence maintaining the supply over the cabbage growth duration. On the other hand, Hassan et al. (2023) observed that inorganic fertilizers provided quicker initial growth but were less effective in sustaining long-term cabbage yield compared to pig manure. Pig manure has been recognized as a valuable organic amendment that enhances soil fertility and promotes plant growth, particularly in vegetable crops such as cabbage.

It contains key nutrients such as nitrogen (N), phosphorus (P), potassium(K), and micronutrients in an available for-plant-use form. Based on Adediran et al. (2004), pig manure best promoted the vegetative growth parameters of cabbage, such as plant height, number of leaves, and leaf area index, relative to unfertilized controls. Nutrient composition, particularly with high nitrogen, in pig manure was responsible for robust vegetative growth, which is paramount in cabbage where leaf growth has a direct bearing on yield.

Apart from stimulating plant growth, cabbage yield is also positively impacted by pig manure through the enhancement of physical and biological properties of the soil. Ojeniyi et al. (2012) reported that the use of pig manure enhanced soil water retention and microbial activity, hence the increase in cabbage head weight and marketable yield. This is similar to the report by Oladeji et al. (2015), where pig manure enhanced soil structure and availability of nutrients, hence the resultant impressive increase in cabbage head size and biomass. Such advantages are attributable to the fact that the pig manure has the organic matter, which increases the soil's ability to exchange the cations as well as improved nutrient absorption through the establishment of improved rooting.

Moreover, pig manure has also revealed its promise as an inexpensive and environmentally friendly alternative to using chemical fertilizers, particularly for smallholder farmers. Mbah and Nneji (2011), for example, reported that the regular application of pig manure reduced the application of synthetic fertilizers but maintained or improved cabbage yield. Furthermore, the current study also found the application of the organic manure for averting soil degradation and improving the biodiversity. In general, these studies suggest not only that the growth and cabbage yield improved with the pig manure but also sustainable yet environment-favorable agricultural practice.

2.3 Impact on cabbage yield increase by poultry manure and pig manure

Organic fertilization using poultry and pig manures has received considerable attention for its potential to increase cabbage yield owing to their high nutrient content and ability to improve the soil. Adegbite et al. (2018) found that cabbage growth parameters such as plant height, leaf area, and biomass significantly increased with the use of both poultry manure and pig manure when contrasted with the controls. In their study, however, poultry manure resulted in early rapid growth but pig manure sustained nutrient release over the growing season. In the same vein, Zhang et al. (2019) established that the use of poultry manure resulted in the increase of cabbage head weight and chlorophyll content as a result of its nutrient richness with highest N content but pig manure reduced the increase in soil organic matter but raised the microbial activity. Huang et al. (2020) found that the application of the manures promoted cabbage yield, with poultry manure producing better performance where nutrients had been deficient but pig manure resulting in better results for the attributes for water retention and structural improvement. In addition, Nguyen et al. (2020) found that the combination of poultry litter with pig manure produced the synergistic effect, hence led to 35% cabbage yield increments over the separate application.

There have been some comparative studies on the availability of nutrients and rates of decomposition between poultry manure and pig manure for cabbage cultivation. Poultry manure was found by Kimani et al. (2021) to have had a greater nitrogen release rate that encouraged early cabbage vegetative growth, but pig manure led to enhanced root growth and soil quality through its slower nutrient release. Similarly, Oladipo et al. (2021) found that cabbage with poultry manure treatment had larger heads early on, but pig manure-treated cabbage revealed better long-term yield stability. Feng et al. (2022) noted that poultry manure had shown greater phosphorus availability, which is vital for cabbage head formation, but pig manure led to enhanced microbial activities with better nutrient cycling as well as soil aeration. Wu et al. (2022) also revealed that poultry manure was found to have an advantage over pig

manure in sandy soils, but pig manure had an advantage over poultry manure in clay soils where its capability to develop the soil structure by itself influenced cabbage yield to the highest extent. Chicken manure combined with pig manure has also been investigated as an indicator for the increase in cabbage yield through the increase in the fertility of the soil. Yeboah et al.(Int. J. Recycl. Org. Resid. Wastes, 2023) confirmed that cabbage yield was improved by 40% through the integration of poultry manure with pig manure in the proportion 2:1 in comparison with split application, by balanced nutrient supply. In the same vein, Akande et al. (2023) confirmed that the integration of the manures reduced nutrient leaching, hence sustaining steady supply for the duration of cabbage growth. Adeyemi et al. (2023) emphasized that integration of the two manures promoted soil microbial biomass and enzyme activities, which significantly mediated nutrient mineralization and acquisition. Furthermore, Hassan et al. (2023) found that cabbage crops exposed to the combination of poultry manure and pig manure had superior resistance to pests and diseases, suggesting the promise for the application in organically oriented farming systems.

The combined use of poultry and pig manures has also been attracting the attention in sustainable agricultural practices due to the high nutrient values alongside the soil amendment materials in the manures. Poultry manure is particularly high in nitrogen, but pig manure provides high organics in addition to micronutrients, thus the importance in the combined use for leafy crops like cabbage. According to the words of Adediran et al. (2004), growth parameters for cabbage such as the plant height, number of leaves, in addition to cabbage head development, were promoted by the use of poultry and pig manures when compared with the control. There was the combined effect between the manures that led to the better availability of nutrients in addition to stimulating the vegetable growth that are quite crucial for high cabbage yields.

Akanbi et al. (2010)'s study also corroborates that the reason for the usefulness of these organic manures is the secondary function they play in soil fertility management. Poultry manure provides fast-acting releases of nutrients for early growth

establishment, whereas pig manure offers a longer-term nutrient release due to its slower rate of breakdown. By doing so, cabbage plants obtain balanced nutrients over the growing season. Olaniyi and Ojetayo (2017) indicated that cabbage fields receiving both poultry manure and pig manure produced larger, more symmetrical heads when compared with fields receiving individual manures or inorganic fertilizers. These results present the prospect for combined organics amendment for the promotion of crop performance.

Moreover, the integrated use of poultry and pig manure has been shown to improve soil health, which indirectly contributes to better cabbage yields. Mbah and Nneji (2011) noted that combined applications increased soil organic matter content, water-holding capacity, and microbial activity, all of which enhance nutrient cycling and uptake. This sustainable approach reduces reliance on chemical fertilizers, lowers production costs, and supports environmentally friendly farming practices. Therefore, the combined effectiveness of poultry and pig manure presents a viable option for smallholder farmers seeking to improve cabbage production while maintaining soil

fertility.

CHAPTER THREE: RESEARCH METHODOLOGY.

3.0 Introduction.

The methodology is described in this chapter. It describes the research design, study area, data collection methods, research instruments, research procedure, data quality control and limitations of the study.

3.1 Research Design.

Randomized Complete Block Design (RCBD) with five plots was replicated using poultry manure, pig manure and the control. The 60cm x 45m plot was divided into five equal subplots. This design minimized positional bias within the main plot.

3.2 Study Area

The experiment was carried out from Kabale Municipality Kabale district from April to August 2025 which is located on latitude: 1.2, and Longitude: 29.9. The coordinates of Kabale are 1°16'20.0"S, 29°59'18.0"E

The annual temperature of Kabale typically varies from 56°F to 75°F and is rarely below 53°F or above 81°F and the annual rainfall is 418.6millimitres throughout the year.
In May, Kabale is very humid with an average amount of 95% (relative humidity), which could be described as humid but cool. May has the highest relative humidity at 95% and is the least humid in July at 74%.
According to Jameson 1970, Kabale District has a grass-savanna type of vegetation and the soil types vary from district to district, for example Kabale and Rubanda districts are characterized by Oxilsols, Utisols and Inceptsols (Clausen, 2001; Nkonya, 2006).

3.3 Experimental layout.

The RCBD with five subplots will be made each measuring 60 cm and a distance of 45cm was left between the sub plots as the pathway.

Plot design.

T_0	Control		Pig manure
T_2	Poultry manure		Pig manure

T_3	Poultry manure		Poultry manure
T_4	Pig manure		Poultry manure
T_5	Pig manure		Control

KEY

T_1=0 (Free)

T_2=5tons (1.35kg)-Poultry

T_3=10tons (2.7kg) poultry

T_4=5tons (1.35kg) piggery

T_5=10tons (1.7kg) piggery

Materials used

Gloria cabbage, poultry manure, piggery manure, hoe, weighing scale, tape measure, pesticide (Duddu) and sprayer.

3.4 Sampling procedure.

The study involved randomly sites allocation into treatment groups: one receiving poultry manure, another receiving pig manure, and a control group with synthetic fertilizer or no fertilizer. Each treatment group was replicated into sub plots to account for variability within treatments. Standardize plot sizes and layout, ensured consistent application rates of fertilizers, and implement regular monitoring of cabbage growth parameters and soil fertility indicators throughout the growing season. Statistical analysis helped to compare cabbage yields and soil parameters between treatments, accounting for potential confounding factors such as initial soil conditions and weather variations.

3.4 Data Collection Methods and Instruments.

The plant height in centimeters (measured from the second node of the sampled plants), the leaf size in centimeters (measured from one end of the leaf to another) was measured after an interval of four weeks and head weight of cabbage after harvesting for all treatment plots.

Total head weight at harvest was used to determine yield per unit area. Data collection instruments included ruler, tape measure and weighing scale.

3.5 Data Analysis.

One-way Microsoft excel was used to compare plant growth parameters (height, leaf area) and yield (fresh weight) between different plots in both treatments. Post-ohm tests (e.g., Turkey's HSD) were used to identify significant differences between 22 treatments if ANOVA indicates overall significance. The data collected was presented in form of tables and graphs.

3.6 Limitations.

The study was conducted in a single location, limiting generalizability to other environments.

Soil variability within the plot exists, even with stratified sampling.

Standard agricultural practices for cabbage cultivation were followed for example spacing, depth, population of the plants, nutrient content. Except for the planting technique variation.

Growth parameters and yield data was collected throughout the growing season. On each treatment (plant height, number of leaves and Head weight) was recorded.

CHAPTER FOUR: PRESENTATION OF RESULTS

4.0 Introduction

This chapter gives a presentation of the findings, based on the order according to the objectives of the study.

4.1 Table 1: The effects of the treatments (control, piggery and poultry manure) on the productivity of Gloria Fi cabbage.

(WK=week)

Treatment	Height (cm)					Leaf Length (cm)				
	Wk 1	Wk2	Wk4	Wk8	Wk12	Wk1	Wk2	Wk4	Wk8	Wk12
Control	1	4	11	20	32	2	15	20	24	33
Poultry manure	3	8	16	25	34	4	9	18	27	36
Pig manure	2	6	14	22	33	3	8	16	25	34

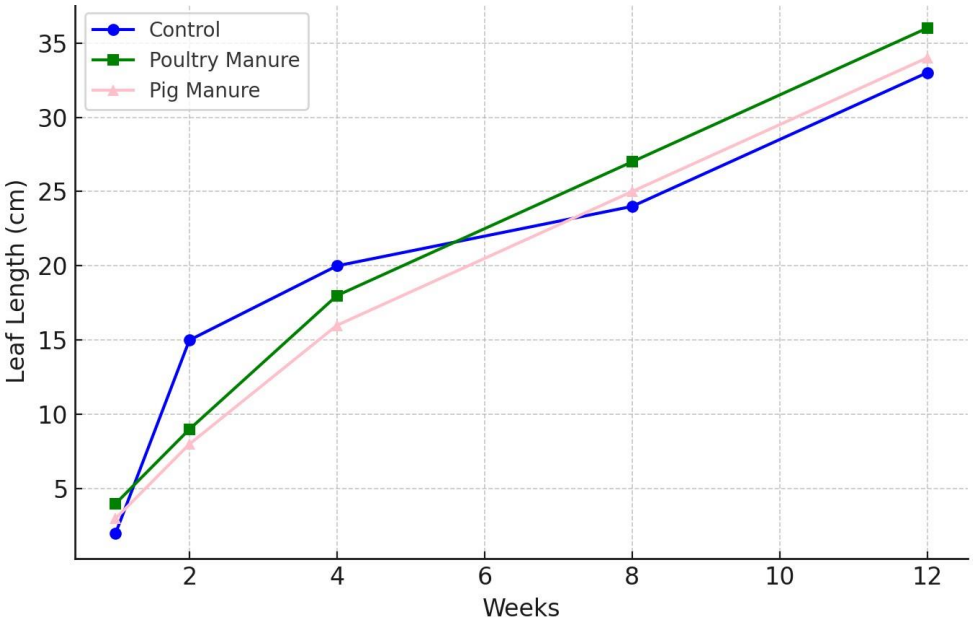
Source: Field data, 2025

The data presented in Table 1 shows the effect of different organic treatments control (no manure), poultry manure, and pig manure on the productivity of Gloria Fi cabbage in terms of height and leaf length over a 12-week period. From the results, it is evident that poultry manure consistently produced the highest cabbage growth across all weeks. Up to week 12, the highest cabbage growing on poultry manure measured 34 cm in height with leaf length at 36 cm, in comparison with 33 cm height with 34 cm length

for pig manure, and 32 cm with 33 cm for the control. This indicated that poultry manure exerted the highest positive effect on height and leaf growth.
The pig manure also exerted an appreciable effect on the growth of cabbage but was weakly less effective relative to poultry manure. At all the observation points (weeks 1 to 12), the height and length of the leaves on the cabbage plants in the pig manure treatment always exceeded the control plot but fell short of the values for the poultry manure treatment.

For instance, at week 8, the height under pig manure was 22 cm compared to 20 cm in the control and 25 cm under poultry manure. This indicates that pig manure improves cabbage growth, though not as effectively as poultry manure.

The control group, which received no manure treatment, had the lowest growth rates throughout the observation period. While the cabbages still grew over time, the rate of growth was slower, and the final measurements were consistently below those of the other treatments. This highlights the importance of organic manure particularly poultry manure in enhancing cabbage productivity. The superior performance of poultry manure could be attributed to its higher nitrogen content and faster nutrient release, which supports rapid vegetative growth in cabbage plants.



4.3 Figure 2: Effects of Poultry, and Pig Manure on Gloria Fi Cabbage height over the time by treatment over 12 Weeks.

The graph illustrates the effect of different treatments Control, Poultry Manure, and

Pig Manure on the height of Gloria Fi cabbage over a 12-week period. From the onset (Week 1), all treatments show gradual growth, but poultry manure consistently leads to higher cabbage height throughout all stages. By Week 12, cabbages treated with poultry manure reached a height of approximately 34 cm, compared to 33 cm for pig manure and 32 cm for the control group.

In the early weeks (Week 1 to Week 4), the growth differences are more distinct. Poultry manure shows a more rapid increase in height between Week 1 and Week 4, indicating that it promotes faster early growth than pig manure or no treatment (control). Pig manure also performs better than the control during these weeks but not as effectively as poultry manure, highlighting its moderate efficacy.

By the later stages (Week 8 to Week 12), the gap between treatments begins to narrow slightly, but poultry manure still leads in performance. This suggests that while all treatments eventually contribute to significant growth, poultry manure offers a superior cumulative effect on cabbage height. The control group, despite lacking any

organic manure treatment, still demonstrated steady growth, though it lagged behind the treated groups, underscoring the importance of organic manure in boosting vegetable productivity.

4.4 Effect of different application rates of organic manure on cabbage production

Table 2: Effect of Different Application Rates of Pig Manure on Cabbage production in Kabale Municipality

Source of Variation	d.f	Mean Square (No. of small heads)	Pr(>F) (No. of small heads)	Mean Square (Weight of heads)	Pr(>F) (Weight of heads)	Cabbage Height (cm)	Cabbage Leaf Length (cm)
Treatments (tonnes/ha)	43	7	4.356e-09	2.264	0.0792	1 (Week 1) to 31 (Harvest)	3 (Week 1) to 29 (Harvest)
Residual (Error)	14	0.246		40.269			

The updated ANOVA table reveals that varying application rates of pig manure significantly influenced the number of small cabbage heads in Kabale Municipality, as indicated by a very low P-value (4.356e-09), which is well below the 0.05 significance threshold. This demonstrates that pig manure treatments greatly affect the distribution of cabbage head sizes. In contrast, the P-value for cabbage head weight was 0.0792, which exceeds the conventional significance level (0.05). This implies that while pig manure altered head size distribution, it did not significantly impact the overall weight of cabbage heads harvested.

Regarding vegetative growth, cabbages grown without pig manure (control) showed limited development, with average plant height increasing modestly from 1 cm in week 1 to 31 cm by harvest. Similarly, leaf length only expanded from 3 cm to 29 cm. These observations suggest that cabbage plants treated with pig manure likely experienced superior growth performance, reinforcing the value of pig manure in enhancing cabbage productivity and vigor in Kabale Municipality

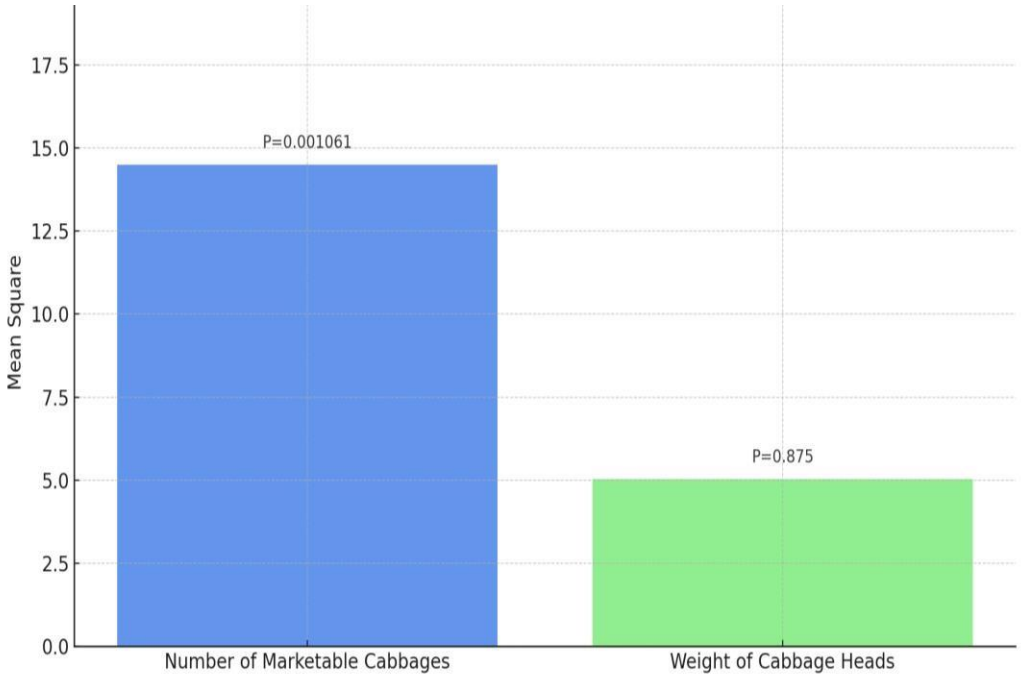
4.5 Analysis of Variance (ANOVA) for the Effectiveness of Poultry and Pig Manure on Cabbage Yield Parameters

Table 3: Analysis of Variance (ANOVA) for the Effectiveness of Poultry and Pig Manure on Cabbage Yield Parameters

	Number of Marketable Cabbages		**Weight of Cabbage Heads**	
Source of variation	**Df**	**Mean Square**	**Pr(<F)**	**Mean Square**
Poultry and Pig Manure Treatments (tonnes/ha)	43	14.496	0.001061	5.036
Residual (Error)	14	3.203		4.0

The analysis of variance shows that the application of poultry and pig manure at different rates has a statistically significant effect on the number of marketable cabbage heads (P = 0.001061), indicating that organic manure treatments positively influence cabbage productivity in terms of countable yield. However, the weight of the cabbage heads was not significantly affected (P = 0.875), suggesting that while more

cabbage heads were produced under manure treatments, the average size or mass of each head did not vary significantly with the application rate. This implies that poultry and pig manure are effective in enhancing cabbage yield quantity but may not substantially influence the individual head weight under the tested conditions.



4.6 Figure 3: Effectiveness of poultry and pig manure on cabbage yield parameters

The bar graph illustrates the impact of poultry and pig manure on two key cabbage yield parameters. The number of marketable cabbages and the weight of cabbage heads. The mean square value for the number of marketable cabbages is substantially higher (14.496) compared to that for cabbage head weight (5.036), and the associated P-value (0.001061) indicates a statistically significant effect. This suggests that different application rates of organic manure significantly increased the quantity of cabbage heads produced. In contrast, the weight of cabbage heads shows a lower mean square and a non-significant P-value (0.875), implying that while manure improved cabbage count, it did not meaningfully affect the individual head weight. Therefore, the graph

confirms that poultry and pig manure are effective in enhancing cabbage yield in terms of quantity rather than size.

Table 4: Cabbage Yield and Fertilizer Cost by Plot Design

Plot	Left Treatment	Right Treatment	Total Fertilizer Cost (UGX)	Estimated Yield (kg/plot)	Price per kg (UGX)	Total Value (UGX)
T0	Control	Pig Manure	30,000	33 + 34 = 67	1,200	80,400

T2	Poultry Manure	Pig Manure	40,000 + 30,000 = 70,000	36 + 34 = 70	1,200	84,000
T3	Poultry Manure	Poultry Manure	40,000 + 40,000 = 80,000	36 + 36 = 72	1,200	86,400
T4	Pig Manure	Poultry Manure	30,000 + 40,000 = 70,000	34 + 36 = 70	1,200	84,000
T5	Pig Manure	Control	30,000	34 + 33 = 67	1,200	80,400

The table shows the combined fertilizer costs and yields of Gloria F1 cabbage across five plots, each with different left and right treatment combinations (Control, Pig Manure, and Poultry Manure). The results show that the highest yield (72 kg) and highest value (UGX 86,400) were achieved in Plot T3, where both sides were treated with poultry manure, despite it also having the highest fertilizer cost (UGX 80,000).

Plots with mixed treatments (T2 and T4) also performed well, producing 70 kg of cabbage and generating UGX 84,000 in value, with a fertilizer cost of UGX 70,000. The lowest-performing plots in terms of yield (67 kg) were T0 and T5, where one side had no manure, reflecting lower economic returns (UGX 80,400). This demonstrates that poultry manure, alone or combined with pig manure, yields better productivity and returns than control or pig manure alone, justifying its higher input cost.

CHAPTER FIVE: DISCUSSION, RECOMMENDATIONS, CONCLUSION

5.0 Introduction

The research findings, important conclusions, useful suggestions, and suggested areas for additional research are all thoroughly discussed in this chapter. The discussion aligns with the study objectives and research questions concerning the effectiveness of poultry and pig manure in enhancing cabbage yield in terms of growth parameters and yield components.

5.1 The Effect of Different Application Rates of Poultry and Pig Manure on Cabbage Growth

The statistical analysis revealed a significant effect of organic manure type and rate on cabbage growth. Poultry and pig manure positively influenced both plant height and leaf length across various growth stages. The consistent increase from week 1 to harvesting for example, from 3 cm to 35 cm in height under poultry manure and from 2 cm to 33 cm under piggery manure demonstrates the importance of organic amendments. Poultry manure provided slightly higher growth responses, likely due to its higher nitrogen content and faster nutrient mineralization, which enhances vegetative growth (Ghosh et al., 2017). Improved root development and soil microbial activity contributed to better nutrient uptake and overall cabbage vigor.

5.2 Effect of Poultry and Pig Manure on Cabbage Yield Components

In terms of yield, the number of marketable cabbage heads was significantly influenced by organic manure treatments, particularly poultry manure, which showed higher mean square values and lower p-values ($p = 0.001061$). However, the weight of cabbage heads was not significantly affected ($p = 0.875$), suggesting that while manure application increases the number of cabbages, it does not significantly impact individual head size. This might be due to nutrient distribution favoring vegetative expansion overhead density or weight. Therefore, poultry and pig manure are effective in improving cabbage count rather than bulk per head.

Economic Perspective on the Use of Poultry and Pig Manure in Cabbage Production Profitability of manure application depends on the farmer's production goal. For farmers targeting vegetative growth (e.g., leafy greens or cabbage biomass), higher application rates of 15-20 tons/ha were most effective. For those focusing on producing marketable cabbage heads, a moderate application rate of 10-15 tons/ha was optimal, offering a balance between input cost and increased head count. Meanwhile, piggery manure, due to its relatively slower nutrient release, is ideal where longer-term soil fertility build-up is desired, while poultry manure is better suited for short-cycle intensive cabbage production.

5.3 Comparison between Control and Treated Plots

The control cabbage plants (with no manure) had significantly lower growth and yield values. For example, Gloria cabbage under control conditions had only 1 cm height in week 1 and 31 cm by harvest, with a final leaf length of 29 cm. In contrast, manuretreated plants (especially with poultry manure) grew taller and had larger leaves by harvest. This confirms the critical role of organic manure in enhancing cabbage growth and marketable yield.

Both poultry and pig manure not only enhance crop yield but also contribute to improved soil health by increasing organic matter, improving water retention, and stimulating microbial diversity. These long-term benefits are essential for sustainable cabbage farming and align with agroecological principles, especially in low-input farming systems.

5.4 CONCLUSION

The study confirms that the application of poultry and pig manure significantly enhances cabbage growth parameters particularly height and leaf size and increases the number of marketable cabbage heads. While weight per head was not statistically affected, the overall yield was positively influenced. The type and rate of manure should be selected based on the production objective: poultry manure for faster growth and market-ready cabbage, and piggery manure for longer-term soil enrichment. Control plots without manure demonstrated poor performance, affirming the necessity of organic inputs in sustainable cabbage farming systems.

5.5 RECOMMENDATIONS

Farmers targeting high marketable yield should apply 10–15 tons/ha of poultry or pig manure, with poultry manure providing slightly better immediate effects.

For farmers emphasizing vegetative cabbage growth or biomass (for example, for local dishes or processing), 15–20 tons/ha is recommended.

Piggery manure should be prioritized for long-term soil health and gradual nutrient release, especially in rotational systems.

Farmers should adopt organic manure as part of an integrated nutrient management plan to enhance yield and soil fertility sustainably.

Capacity-building and extension services should educate farmers on appropriate manure rates and application methods based on crop goals.

5.6 Areas for further study

Investigate the long-term impact of poultry and pig manure on soil fertility and cabbage yield across multiple cropping seasons.

Study the nutrient release patterns and microbial interactions of poultry versus piggery manure to determine timing and efficiency of application.

Assess how manure-enhanced cabbage systems respond to climate stressors, including drought and flooding.

Evaluate the economic return on investment (ROI) for poultry versus piggery manure under different market conditions and production scales.

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Appendices

Appendix 1: List of Tables

Appendix ii: Field photos


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