PRODUCTION OF ORGANIC MANURE FROM, WOOD DROPPINGS AND POULTRY DROPPINGS FOR PLANTING OF VEGETABLES (*Amaranthus*)

BY

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A RESEACH PROJECT SUBMITED TO THE DEPARTMENT OF AGRICULTURAL AND BIO- ENVIRONMENTAL ENGINEERING, INSTITUTE OF TECHNOLOGY, KWARA STATE POLYTECHNIC, ILORIN, KWARA STATE.

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CERTIFICATION

This is to certify that this project titled Effect Of Manure Produce From Sawdust And Poultry Dropping On Growth And Yield Of Vegetable (Amaranthus) was carried out by ABDULLATEEF KABIRAT ODUNOLA with Matric (HND/23/ABE/FT/0017) in partial fulfillment for the award of Higher National Diploma (HND) in Agricultural and BioEnvironmental Engineering Technology, Institute of Technology, Kwara State Polytechnic, Ilorin.

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DEDICATION

This project work is dedicated to Almighty God.

ACKNOWLEDGEMENT

I would like to take this opportunity to express my sincere gratitude to my project supervisor Engr. (Mrs) Baiyeri M.R for her immense support and encouragement throughout this project also my thanks goes to the project coordinator for organizing this project and creating a helpful environment.

I am extremely grateful for the direction and advice provided by my project supervisor at every stage of this project which made the completion of the project possible for me thank you so much may Allah bless you.

I sincerely appreciates the efforts of my dear parent Mr and Mrs Abdulfatai for their unwavering support throughout my programme, may you live long to enjoy the merriment of your sacrifices.

I will be indebted if I didn’t recognize my brothers and sister for their support during these journey. Also I give a big kudos to my project team for their hardworking to achieve this aim. I say thank you to all my colleagues and friend may we all be successful in all our future endeavors.

TABLE OF CONTENT

ABSTRACT

The excessive and unsustainable use of synthetic fertilizers in agriculture has led to significant environmental degradation, soil health decline, and increased production costs. This study was conducted to produce and evaluate the effectiveness of organic manure derived from poultry droppings and sawdust two abundant agricultural wastes in enhancing the growth performance of Amaranthus spp. (green leafy vegetable). The research was carried out at the Agricultural Research Farm of Kwara State Polytechnic, Ilorin, Nigeria. Poultry droppings and sawdust were composted at a 2:1 ratio using aerobic composting techniques for five weeks. Physicochemical properties of the raw materials and compost were analyzed, including pH, nitrogen, phosphorus, potassium, organic carbon, electrical conductivity, and total dissolved solids. The resulting organic manure was applied to experimental vegetable plots and compared with untreated control plots. Laboratory results indicated that poultry droppings were rich in nitrogen (3.58%), phosphorus (11.69%), and potassium (3.26%), while sawdust provided a high carbon content necessary for balancing the C:N ratio (85.93). The final compost had a favorable nutrient balance and structure suitable for plant growth. Amaranthus plants treated with the composted manure exhibited significantly better growth parameters, including stem height, number of leaves, and leaf area, compared to untreated plants. After 21 days, manure-treated plants recorded a stem height of 23.2 cm compared to 6.0 cm in the control, confirming the compost's positive influence on vegetative development. The findings of this study validate the co-composting of poultry droppings and sawdust as a sustainable, eco-friendly, and cost-effective method of organic manure production. It promotes waste recycling, reduces dependence on synthetic fertilizers, and enhances soil fertility for improved vegetable productivity. The study recommends the adoption of this practice by smallholder farmers and calls for further research into optimizing composting techniques for various crop species.

LIST OF TABLES

LIST OF PLATES

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Soil fertility depletion is a major constraint to agricultural productivity in many parts of the world, particularly in Sub-Saharan Africa. The growing reliance on synthetic fertilizers has raised concerns about environmental degradation, soil acidification, and the economic burden on smallholder farmers (Adekiya *et al.,* 2019). Consequently, the focus has shifted toward organic agriculture as a sustainable alternative.

Organic manures are derived from the natural decomposition of plant and animal residues. When properly composted, they enrich the soil with essential nutrients and improve soil physical, chemical, and biological properties. Wood droppings (sawdust) and poultry droppings are two readily available organic materials in most farming communities. Poultry droppings are rich in nitrogen, phosphorus, and potassium, whereas sawdust, though high in carbon, has limited nutrient availability and decomposes slowly due to its high C:N ratio (Ewulo *et al.,* 2008). When combined appropriately, these materials can yield nutrient-rich compost that is suitable for crop production, particularly vegetables which have high nutrient demands.

Vegetable production, such as for spinach, okra, lettuce, and tomatoes, requires fertile soils with good structure and adequate water retention. This study explores the production of organic manure from sawdust and poultry droppings, aiming to utilize agricultural waste effectively and promote sustainable vegetable farming.

1.2 Problem Statement

Excessive use of chemical fertilizers has resulted in soil degradation, increased production costs, and ecological imbalance. Moreover, wood waste and poultry manure are often discarded improperly, contributing to environmental pollution. There is an urgent need to develop a cost-effective, eco-friendly, and sustainable method of managing these wastes while enhancing agricultural productivity.

1.3 Aim and Objective of the Study

The aim of this project is to produce organic manure from a mixture of wood droppings (sawdust) and poultry droppings and determine it performance on the growth of vegetable

Objectives

The specific objectives of the study are to:

i. collect sample of poultry dropping and sawdust
ii. produce organic manure from the poultry droppings and sawdust
iii. determine the physicochemical properties of the manure produced and the soil for planting
iv. to carryout performance of the organic manure produced on the growth and yield of vegetable (*amaranthus*)

1.4 Justification of the Study

The overuse of synthetic fertilizers has led to serious environmental and economic consequences. This study addresses waste pollution by converting poultry droppings and sawdust into beneficial organic manure. Poultry droppings are high in nutrients, while sawdust serves as a carbon-rich bulking agent. The study provides valuable insights into sustainable waste management and offers affordable solutions for smallholder vegetable farmers.

The study is also justified by its practical relevance to small-scale farmers and institutions like Kwara State Polytechnic, as it promotes low-cost, eco-friendly, and locally adaptable solutions to enhance vegetable production particularly *Amaranthus* spp., which is widely consumed in Nigeria.

1.5 Scope of the Study

This study is limited to the production and evaluation of organic manure derived from poultry droppings and wood droppings (sawdust) and application of the organic manure produced for growing green leafy vegetables (*Amaranthus* spp.)

Moreover, the findings will provide useful information on the composting process, nutrient quality of the manure, and its actual performance on crop growth under field conditions. It contributes to the promotion of sustainable agriculture, waste management, and the development of alternatives to chemical fertilizers, thereby benefiting researchers, students, farmers, and policy-makers

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of Organic Manure

Organic manure consists of decomposed biological materials from plants or animals. It enhances soil fertility, improves physical structure, stimulates microbial activities, and slowly releases nutrients (Zheljazkov*and*Warman, 2004). The use of organic manure as a sustainable alternative to synthetic fertilizers is gaining traction globally due to its role in improving soil fertility, promoting environmental sustainability, and reducing production costs. This chapter presents a review of existing literature related to organic manure, focusing on wood droppings (sawdust), poultry droppings, composting techniques, and their effects on soil and crop productivity.

2.2 Concept of Organic Manure

Organic manures are materials derived from plant or animal residues that decompose to release nutrients beneficial to plants. They improve soil structure, enhance microbial activity, and increase the availability of essential macro- and micronutrients (Palaniappan*and*Annadurai, 2007). Unlike synthetic fertilizers, organic manure releases nutrients slowly, thus reducing the risk of leaching and environmental degradation (Zheljazkov*and*Warman, 2004).

2.3 Types of Organic Manure

2.3.1 Animal-based manure

Poultry droppings are one of the most nutrient-rich organic manures. They contain high levels of nitrogen, phosphorus, potassium, calcium, and magnesium (Ojeniyi *et al.,* 2002). They decompose quickly and enhance both soil fertility and crop yield.

2.3.2 Plant-Based Manure

Wood droppings, commonly known as sawdust, are carbon-rich and used primarily to increase the carbon-to-nitrogen (C:N) ratio in compost. On their own, sawdust decomposes slowly and may lead to nitrogen immobilization (Agbede, 2009), but when mixed with nitrogen-rich materials like poultry manure, they form a balanced compost.

2.4 Composting Techniques

Composting is a controlled aerobic process where organic materials are biologically decomposed into a stable humus-like product (Tiquia *et al.,* 2002). Factors influencing composting include moisture content, temperature, aeration, C:N ratio, and microbial activity. Poultry droppings and sawdust form a complementary mix due to their opposing nutrient characteristics—sawdust being carbon-rich and poultry manure nitrogen-rich (Bernal *et al.,* 2009).

Composting is an aerobic microbial process that transforms organic waste into humus. The success of composting depends on C:N ratio, moisture, aeration, and temperature. Poultry manure supplies nitrogen while sawdust provides carbon (Tiquia *et al.,* 2002; Bernal *et al.,* 2009).

2.5 Composition of Poultry Manure and Sawdust

Poultry manure typically contains:

i. Nitrogen (N): 1.5–3.5%

ii. Phosphorus (P): 1.0–2.0%

iii. Potassium (K): 1.0–2.5%

Sawdust on its own has low nutrient content but is essential for balancing the C:N ratio (Idehen *et al.,* 2010). When combined, poultry manure provides the nutrients while sawdust serves as a bulking agent.

2.6 Effect of Organic Manure on Soil Properties

The application of organic manure improves soil structure, increases water retention, and enhances biological activity (Ewulo *et al.,* 2008). It also raises soil organic matter and promotes the availability of nutrients like nitrogen and phosphorus. Organic amendments can also buffer soil pH and reduce aluminum toxicity in acidic soils (Nziguheba *et al.,* 2002).

2.7 Organic Manure and Vegetable Production

Vegetables require nutrient-rich soils for optimal growth. Organic manure has been shown to improve the yield and quality of crops like tomato, okra, spinach, and pepper. According to Adekiya *et al*. (2019), poultry manure significantly increased tomato yield compared to chemical fertilizer under similar conditions. When used in combination with sawdust compost, improvements were observed in soil fertility and vegetable performance.

2.8 Limitations of Organic Manure Use

i. Despite its benefits, organic manure presents some limitations:
ii. Variable nutrient content
iii. Slow nutrient release
iv. Risk of pathogenic contamination if not properly composted (Gajalakshmi*and*Abbasi, 2008)
v. Labor-intensive preparation process

However, these limitations can be mitigated through proper composting techniques, regular monitoring, and field trials.

2.9 Summary of Literature Gaps

Although multiple studies highlight the benefits of poultry manure and sawdust in soil improvement, few have specifically focused on their combined composting and direct application to vegetable crops. This study seeks to fill that gap by exploring optimal composting ratios and their impact on vegetable growth and yield.

2.10 The Physicochemical Properties of Poultry Droppings, Sawdust, Soil and Water.

2.10.1: Physicochemical properties of poultry droppings:

pH: 6.8 - 7.5

Nitrogen: 2.5 - 3.5%

Organic Carbon: 20 - 25%

Phosphorus: 400 - 800 mg/kg

2.10.2: Physicochemical Properties of Sawdust:

pH: 5.5 - 6.7

Nitrogen: 0.2 - 0.5%

Organic Carbon: 40 - 50%

Low phosphorus content

2.10.3: Physicochemical properties of soil:

pH: 6.3 - 6.8

Organic Carbon: 1 - 3%

Nitrogen: 0.1 - 0.3%

2.10.4: Physicochemical Properties of Water:

EC: 200 - 500 µS/cm

TDS: 100 - 300 ppm

Source :(FAO, 2001; Nziguheba *et al.,* 2002; Idehen *et al.,* 2010)

2.11 Determination of Physicochemical Properties of Organic and Soil Materials

The physicochemical analysis of poultry droppings, sawdust, soil, and water provides essential data for evaluating their composting suitability and influence on plant growth.

2.11.1 Poultry droppings

Moisture content is determined by oven drying at 105°C for 24 hours (Muhammad *et al.,* 2020). The pH is measured in a 1:5 slurry with distilled water using a digital pH meter (Ogunwande *et al.,* 2019). Total nitrogen is assessed by Kjeldahl digestion, where nitrogen is converted to ammonia and titrated (Anderson*and*Ingram, 2021). Phosphorus content is measured via the molybdenum blue spectrophotometric method (Sparks, 1996). Organic carbon is estimated using the Walkley-Black method, involving dichromate oxidation and back titration (Nelson*and*Sommers, 1996).

2.11.2 Sawdust

Sawdust samples are dried to determine moisture content as done for poultry droppings. The pH is measured similarly, in a 1:5 water mixture (Awasthi *et al.,* 2016). Organic carbon is analyzed by Walkley-Black oxidation, and nitrogen by the Kjeldahl method. The carbon-to-nitrogen (C:N) ratio is calculated as organic carbon (%) divided by total nitrogen (%) (Haug, 1993).

2.11.3: Soil

Soil pH is determined in a 1:2.5 soil-to-water mixture using a pH meter (FAO, 2007). Organic carbon and nitrogen are determined using the Walkley-Black and Kjeldahl methods, respectively. Available phosphorus is extracted by Bray-1 or Olsen methods depending on soil pH (Sparks, 1996). Soil texture is analyzed by the hydrometer method, and electrical conductivity is measured in a 1:5 suspension using a digital EC meter (FAO, 2008).

2.11.4 Water

Water pH and EC are measured directly using digital meters. Total dissolved solids (TDS) are measured with a TDS meter or calculated from EC using the formula TDS = EC × 0.64 (FAO, 2008). Calcium and magnesium are determined by EDTA titration, while sodium and

Table 2.1 Showing the Physical and Chemical Properties Summary of Poultry Droppings, Sawdust, Soil and Water

Parameters	Soil	Water	Poultry Droppings	Sawdust
PH	**6.3-6.8**	**6.5-7.2**	**6.8-7.5**	**5.5-6.7**
Nitrogen (%)	0.1-0.3	Trace	2.5-3.5	0.5-0.2
Phosphorus (mg/kg)	10-30	Low	400-800	Very low
Organic carbon (%)	1-3	N/A	20-25	40-50
Electrical Conductivity.	Moderate	Low	Moderate	Low

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area

The research was carried out at Kwara State Polytechnic Agricultural Research Farm, (Akwo village), Ilorin East Local Government Area, Kwara State, Nigeria.

Latitude: 8.5215° N

Longitude: 4.5903° E

The region lies within the southern Guinea savannah agro-ecological zone, known for vegetable farming and moderate rainfall suitable for composting and plant growth.

3.2 Materials Used

The following materials and equipment were used during the course of the study:

3.2.1 Organic Materials

i. Poultry droppings (from the Polytechnic poultry farm)

ii. Sawdust (from untreated wood at a local carpentry workshop)

iii. Water (borehole source)

iv. Topsoil (from the vegetable plot)

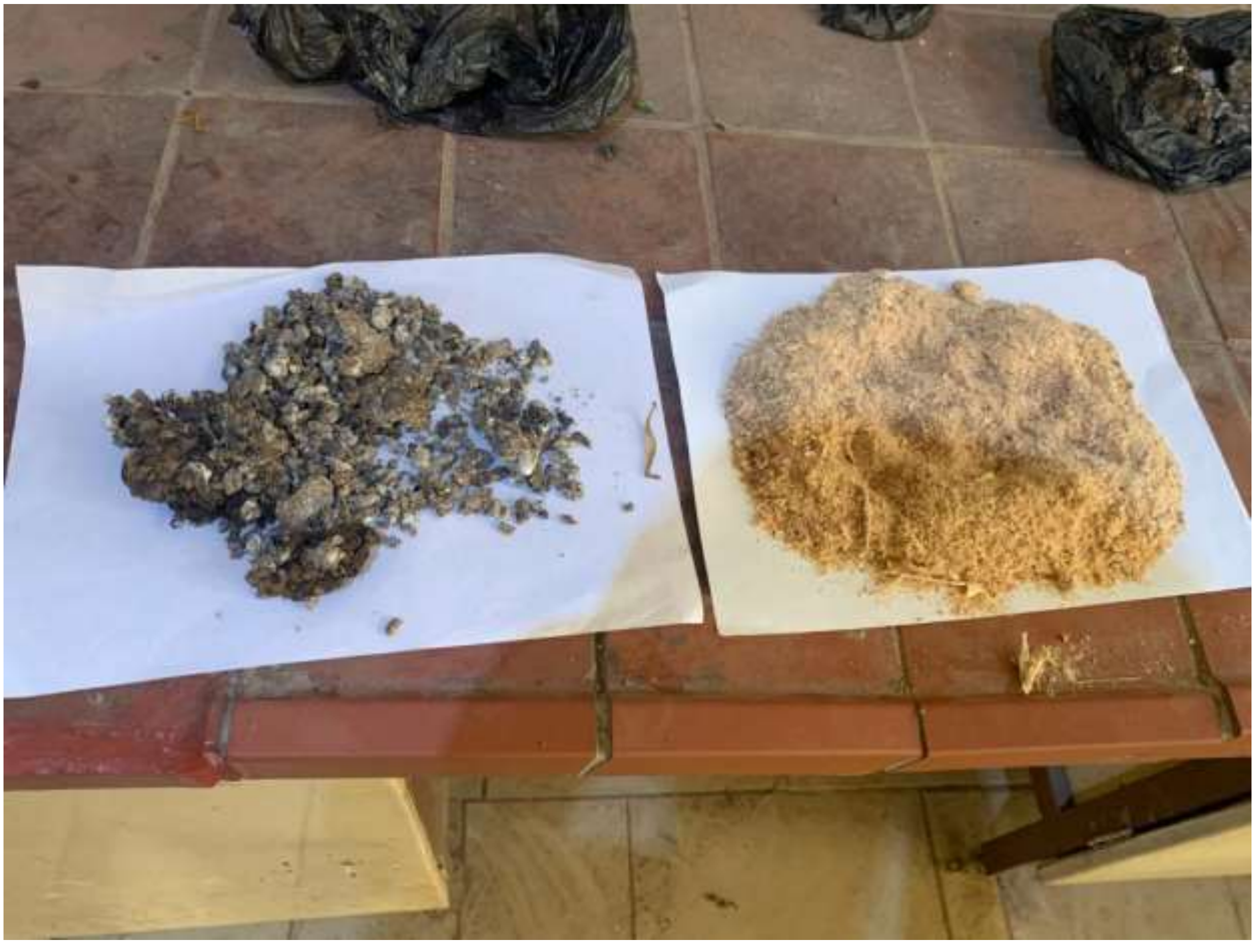

Plate 3.1 Presenting the Samples of poultry Droppings and the Sawdust.

3.2.2 Composting Tools

i. Shovel, hand trowel, and hoe
ii. Black polythene compost bags
iii. Thermometer
iv. Gloves, nose masks, apron

3.2.3 Laboratory Equipment and Instruments

Instrument	Model/Type	Purpose
Digital weighing balance	Sartorius electronic scale	For measuring samples accurately
Oven dryer	Hot-air oven (105^0C)	For moisture content analysis
pH meter	Digital pH meter	For measuring acidity/alkalinity
Kjeldahl apparatus	Digestion + distillation unit	For determine nitrogen content
Soil thermometer	Analog	For monitoring compose temperature
Sieve set	2mm, 1mm mesh	For particle size analysis
TDS meter	Portable	For testing dissolve solids in water
Conductivity meter	Digital	For checking EC of water sample

3.3 Methods

3.3.1 Sample Collection

i. Soil Sample: Collected from 0–20 cm depth using a soil auger, air-dried, and sieved through a 2 mm mesh.
ii. Poultry Droppings: Fresh droppings were collected and sun-dried for 3–4 days to reduce moisture and odor.

iii. Sawdust: Obtained from untreated wood, sieved to remove large particles and stored in a dry place.

iv. Water Sample: Borehole water was collected in sterilized plastic bottles and used both in composting and for laboratory tests.

3.4 Composting Procedure

1. Mixing Ratio: A 2:1 ratio by weight of poultry droppings to sawdust was used.
2. Moisture Adjustment: Water was added until the mixture reached around 60% moisture content.
3. Composting: The mixture was placed in black polythene bags with holes for ventilation.
4. Turning: The mixture was turned every 3–4 days using a shovel to improve aeration and microbial activity.
5. Temperature Monitoring: A compost thermometer was inserted into the core of the pile to track microbial activity.
6. Duration: Composting lasted for 5 weeks. Maturity was indicated by dark color, crumbly texture, and earthy smell.

3.5 Determination of Physicochemical Properties of Poultry droppings, Sawdust, Soil and Water.

3.5.1 Moisture content of poultry droppings, sawdust, and soil.

Samples were weighed, oven-dried at 105°C for 24 hours, then reweighed. The moisture content was calculated using:

Moisture (%) = ((Initial Weight - Dry Weight) / Initial Weight) × 100

(Muhammad *et al.,* 2020)

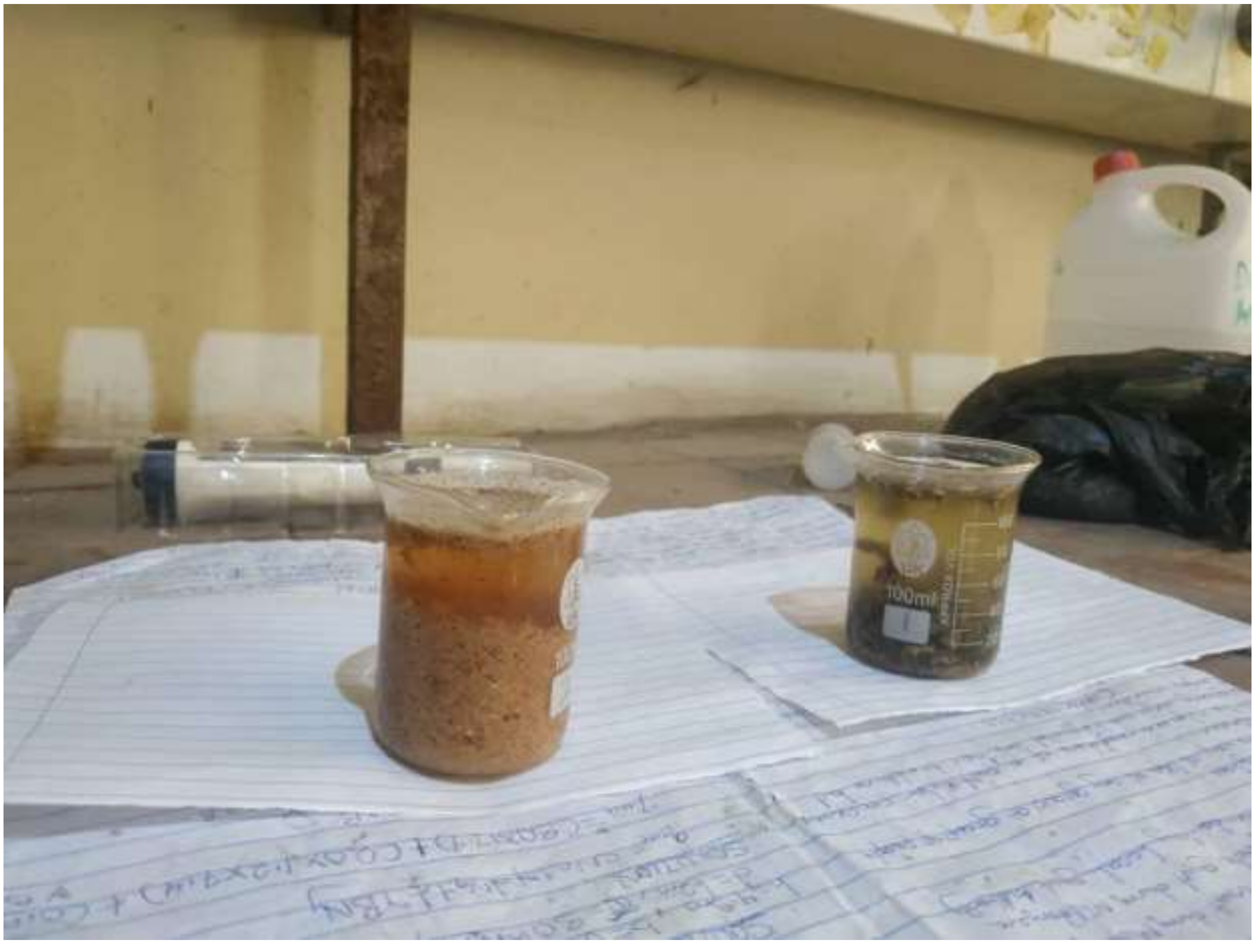

Plate 3.2 Showing the Process of Determination of Physicochemical Properties of Poultry droppings, Sawdust, Soil and Water

3.4.2 pH Measurement of poultry droppings, sawdust, soil and water

A 1:5 ratio of sample to distilled water was used. The suspension was stirred, allowed to stand for 30 minutes, and then measured using a calibrated pH meter. (Ogunwande *et al.,* 2019)

3.4.3 Total nitrogen of poultry droppings, sawdust, and soil.

Determined via Kjeldahl digestion. Samples were digested with sulfuric acid and a catalyst, followed by distillation and titration. (Anderson*and*Ingram, 2021)

3.4.4 Phosphorus of poultry droppings, sawdust, and soil.

Phosphorus was extracted through acid digestion and quantified using the molybdenum blue method via spectrophotometry at wavelength of 880 nm. (Sparks, 1996)

3.4.5 Organic carbon of poultry droppings, sawdust, and soil.

Organic carbon was determined using the Walkley-Black method involving wet oxidation with dichromate and titration.

(Reference: Nelson*and*Sommers, 1996)

3.4.6 Electrical Conductivity (EC) of Soil and Water

A 1:5 suspension of sample to distilled water was prepared soil/water mixture and measured EC using a digital EC meter.

(Reference: FAO, 2008)

3.4.7 Total Dissolved Solids (TDS) of Water

TDS was measured directly using a TDS meter or calculated as: TDS (mg/L) = EC (µS/cm) × 0.64 (FAO, 2008)

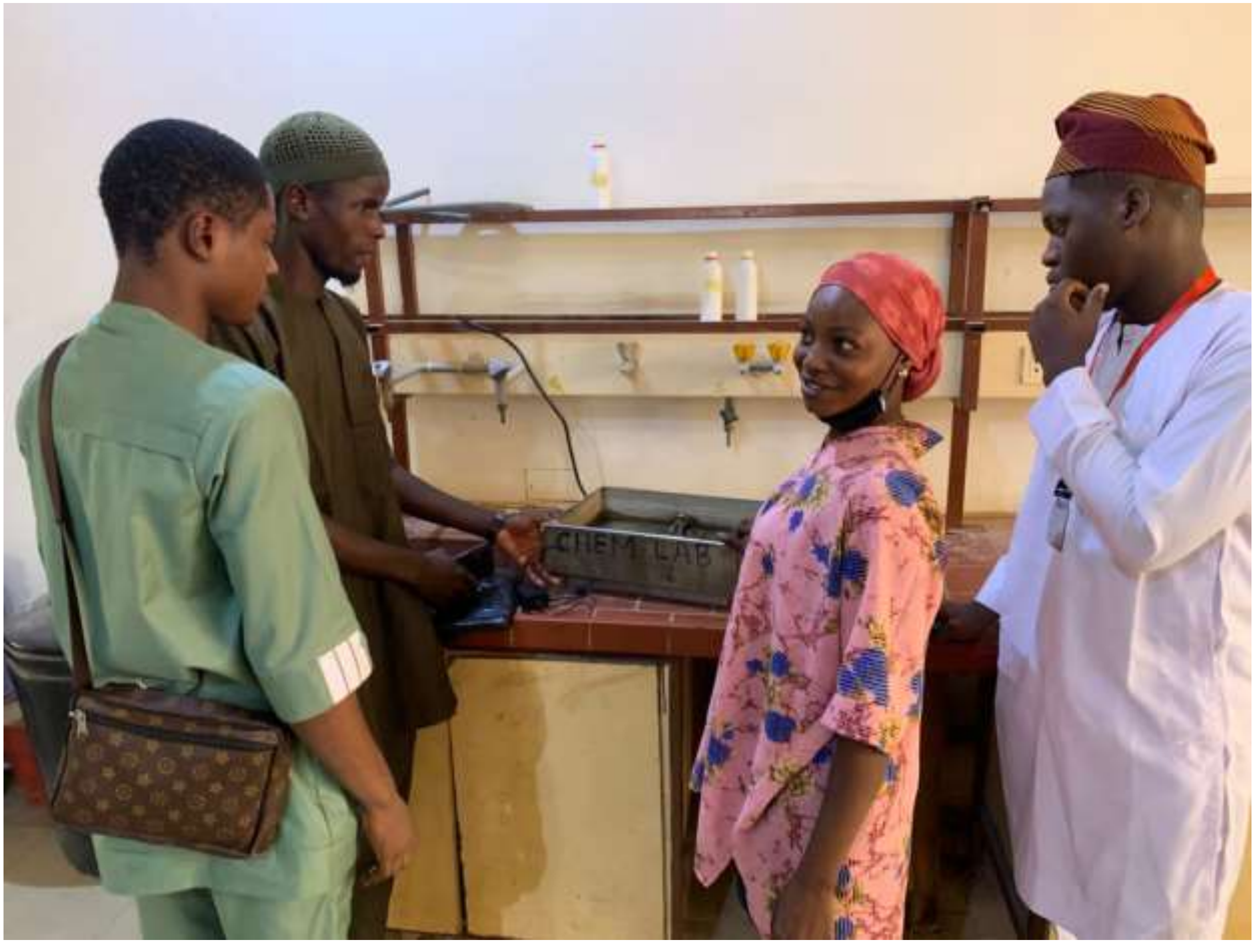

Plate 3.3 Presenting the Physiochemical Testing of Samples.

3.5. Physical Properties of Poultry Droppings, Sawdust, and Soil.

1. Moisture Content

   i. Poultry Droppings, Sawdust, and Soil samples were weighed using the Sartorius balance.

   ii. Placed in an oven dryer at 105°C for 24 hours.

   iii. Moisture content was calculated by the difference in weight before and after drying.

2. Particle Size of Poultry Droppings, Sawdust, and Soil.

i. Dried samples of Poultry Droppings, Sawdust, and Soil were sieved through mesh sizes of 2 mm and 1 mm.
ii. The fractions retained were weighed to determine texture uniformity.

3. Temperature

i. A soil thermometer was inserted into the compost to record internal temperature daily.

B. Chemical Properties of Poultry Droppings, Sawdust, Soil and Water

1. pH Measurement

i. 10g of each sample was mixed with 50 ml of distilled water (1:5).

ii. After 30 minutes of settling, a digital pH meter was used to read the pH.

2. Nitrogen Content

i. Determined using the Kjeldahl method.

ii. Samples were digested with sulfuric acid and catalyst.

iii. Ammonia released was distilled and titrated to determine nitrogen concentration.

3. Electrical Conductivity (Water)

i. EC of borehole water was measured using a digital conductivity meter.

ii. Results were recorded in µS/cm.

4. Total Dissolved Solids (Water)

i. TDS meter was used to determine the amount of minerals in the water sample.

ii. Readings were in ppm (parts per million)

3.6 Application of Compost to *Amaranthus* Plot, Planting and Post Post-Planting Management

An experimental plots was prepared using polythene grow bags

Bag A (Treatment): Soil + composted manure

Bag B (Control): Soil only

The compost was thoroughly mixed with the topsoil before planting. Equal quantities of *Amaranthus* seeds were sown in both bags. The experiment was maintained under similar environmental conditions. Watering was done daily using borehole water. Weed control was done manually as needed.

Plate 3.4 Soil Samples with the Mixtures of Poultry Droppings

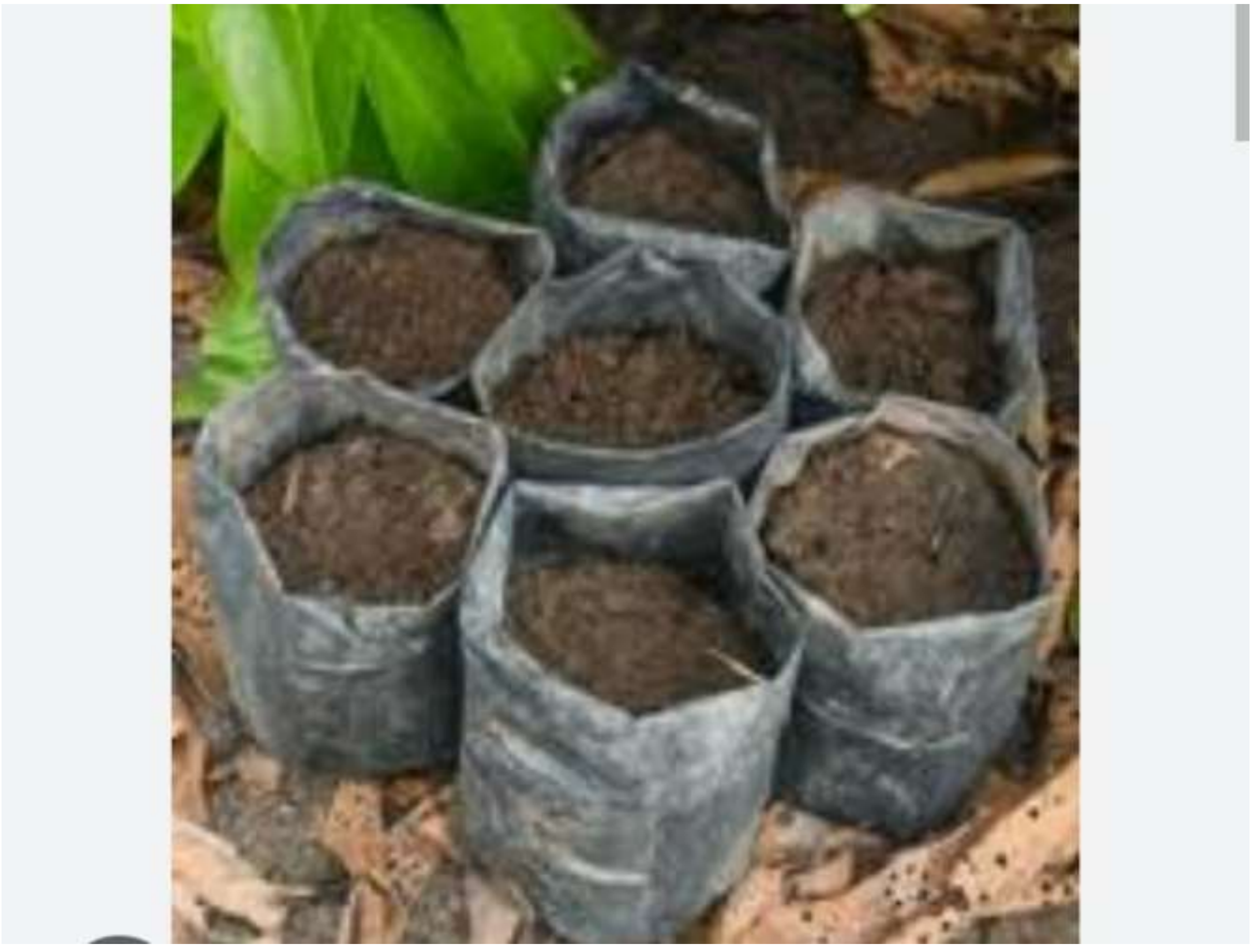

Plate 3.5 Presenting the Plot of Soil Prepared for planting

3.7 Planting and Monitoring 0f the *Amaranthus*

Planting was done manually by broadcasting seeds in each polythene bag. Thinning was carried out after seedling emergence to allow uniform spacing.

3.8 Growth Parameters Monitoring.

Plant height, Number of leaves, Leaf area were measured weekly using a measuring tape and digital caliper. The growth duration was four weeks, after which data were collected and statistically analyzed to evaluate the performance of the compost.

Plate 3.6 Presenting the *Amaranthus* Planted Treated with Organic Manure

Plate 3.6 Showing the Plot of Untreated *Amaranthus*

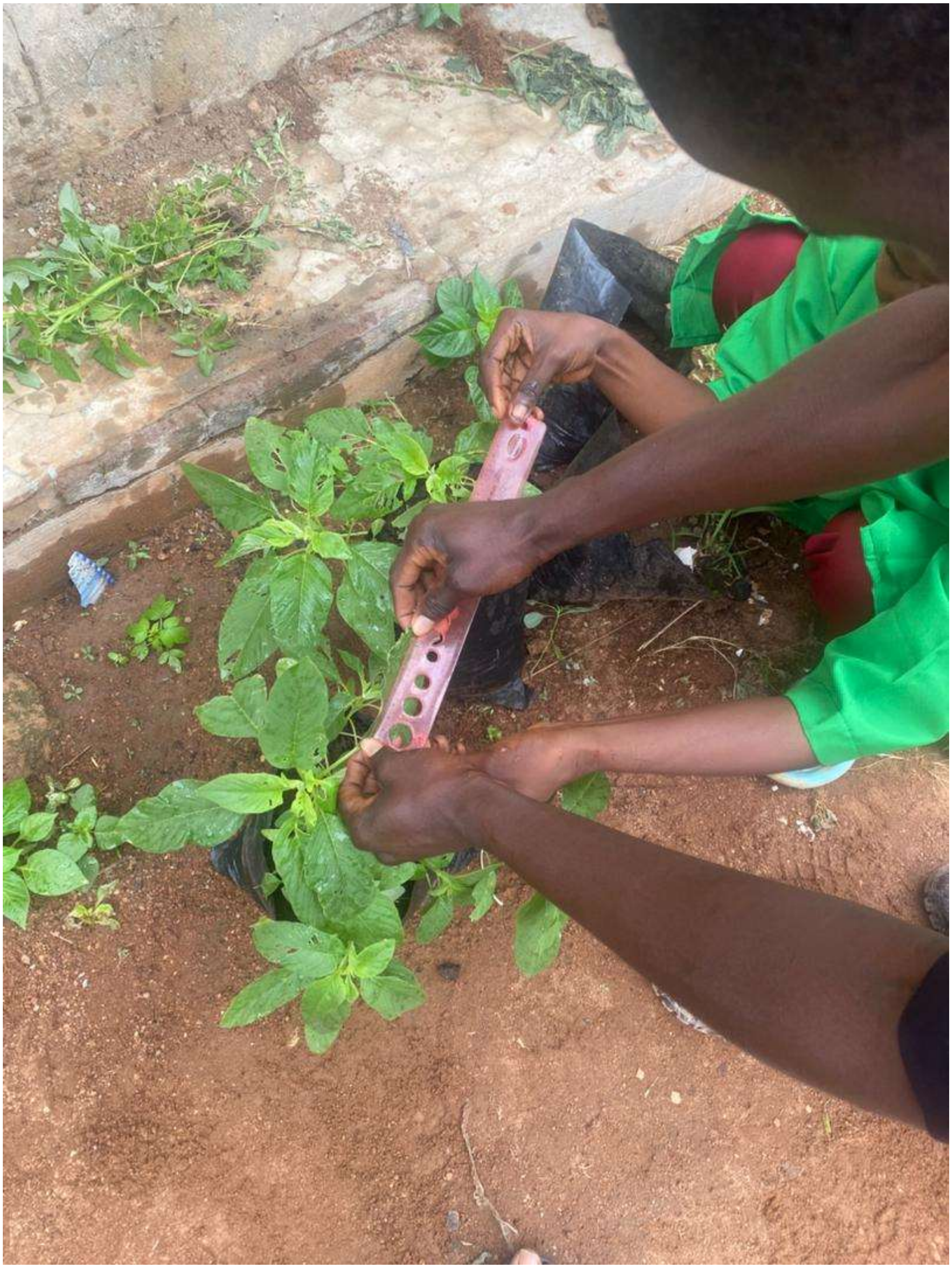

Plate 3.7 Showing the Process of the *Amaranthus* Growth measurement

3.9 Data Analysis

Growth data were analyzed using descriptive statistics including:

Mean values, Standard deviation. Comparisons were made between treated and untreated plots.

3.10 Safety Measures

i. PPE (gloves, face mask, apron) was worn during composting and lab work.

ii. Composting was done in an open area to minimize odor and contamination.

iii. Lab instruments were cleaned after use.

iv. Poultry waste was handled and treated hygienically.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Table 4.1 This chapter present the results obtained from the laboratory analysis of poultry droppings, sawdust, soil and water use in this research work.Table 4.1 showing the result of the water quality analysis, Table 4.2 presenting the result of the laboratory test for poultry droppings, Table 4.3 showing the result of nutrient contents of poultry droppings, Table 4.4 presenting the laboratory test results for sawdust, Table 4.5 presenting the nutrient content of sawdust while Table 4.6 showing the *amaranthus* growth rates and also presented the discussions of the results and comparison with the existing related studies.

Table 4.1 showing the Result of the Water Quality Analysis

Parameter	Full Name	Result	Unit	Remarks
Ph	Potential of Hydrogen	8.10	-	Slightly alkaline
N (%)	Nitrogen	0.079	%	Trace level
Na+	Sodium Ion	1.720	mg/L	Normal range
K+	Potassium Ion	0.350	mg/L	Adequate
Ca2+	Calcium Ion	0.480	mg/L	Beneficial to plants
Fe+	Iron Ion	0.315	mg/L	Acceptable level
Pb2+	Lead Ion	0.475	mg/L	Slightly elevated
Zn2+	Zinc Ion	0.015	mg/L	Trace amount
Mn2+	Manganese Ion	0.010	mg/L	Trace amount
Cd2+	Cadmium Ion	ND	mg/L	Not detected (Good)
Cr2+	Chromium Ion	ND	mg/L	Not detected (Good)

Table 4.2 Presenting the Result of the Laboratory Test for Poultry Droppings

Parameter	Unit	A1	A2	Average
Moisture Content	%	52.14	51.90	52.02
pH Value	-	8.38	8.44	8.41
Total Nitrogen (N)	%	3.675	3.478	3.577
Available Phosphorus (P)	%	11.483	11.892	11.688
Organic Matter	%	9.382	9.416	9.399
Carbon to Nitrogen Ratio (C:N)	%	1.477	2.707	2.092
Ammonium Nitrogen (NH4-N)	g/kg	6.28	6.12	6.20
Potassium (K)	%	3.302	3.214	3.258
Bulk Density	g/cm3	1.720	1.710	1.715
Electrical Conductivity (EC)	µS/cm	8.82	8.84	8.83
Total Dissolved Solids (TDS)	mg/L	440	441	440.5
Porosity	-	2.406	2.114	2.260

Table 4.3 Showing the Result of Nutrient Contents of Poultry Droppings

Parameter	Unit	A1	A2	Average
Moisture Content	%	51.90	52.14	52.02
Ash Content	%	3.88	3.92	3.90
Crude Protein	%	10.22	9.70	9.96
Fat and Oil Content	%	2.14	2.09	2.12
Fiber Content	%	2.55	2.84	2.70
Carbohydrate	%	29.31	29.31	29.31
Dry Matter	%	48.10	47.86	47.98
Calorific Value	Kcal/100g	178.02	174.81	176.42

Table 4.4 Presenting the Laboratory Test Results for Sawdust

Parameter	Unit	A1	A2	Average
Moisture Content	%	14.90	12.88	13.89
pH Value	-	6.55	6.52	6.54
Total Nitrogen (N)	%	0.560	0.062	0.311
Available Phosphorus (P)	%	1.684	1.754	1.719
Total Organic Carbon (TOC)	%	5.047	5.067	5.057
Organic Matter	%	8.726	8.761	8.744
Carbon to Nitrogen Ratio (C:N)	%	90.125	81.726	85.926
Ammonium Nitrogen (NH4-N)	g/kg	1.68	1.71	1.695
Potassium (K)	%	1.042	1.020	1.031
Bulk Density	g/cm3	0.882	0.879	0.881
Electrical Conductivity (EC)	µS/cm	7531	7517	7524
Total Dissolved Solids (TDS)	mg/L	3754	3760	3757
Porosity	-	0.435	0.442	0.439

Table 4.5 Presenting the Nutrient Content of Sawdust

Parameter	Unit	A1	A2	Average
Moisture Content	%	14.70	13.88	14.29
Ash Content	%	2.44	2.39	2.42
Crude Protein	%	0.98	0.94	0.96
Fat and Oil Content	%	1.80	1.85	1.83
Fiber Content	%	1.38	1.50	1.44
Carbohydrate	%	78.70	79.44	79.07
Dry Matter	%	85.30	86.12	85.71
Calorific Value	Kcal/100g	334.94	338.17	336.56

4.7 Vegetable Growth Observation

To evaluate the performance of the organic manure in plant development, Amaranthus was planted in two polythene grow bags one with composted organic manure (poultry droppings + sawdust) and one without manure. The stem height, number of leaves, and leaf length were measured every three days for 21 days.

Table 4.6 Showing the *Amaranthus* Growing Rates

Day	Stem Height (cm) with Manure	No of Leaves with Manure	Leaf Length (cm) with Manure	Stem Height (cm) No Manure	No of Leaves No Manure	Leaf Length (cm) No Manure
0	2.1	2	1.0	2.0	2	1.0
3	4.3	3	2.1	3.5	3	1.8
6	6.7	4	3.4	5.0	4	2.4
9	9.8	5	5.0	6.1	5	3.1
12	13.1	6	6.8	7.4	5	3.9
15	16.5	7	8.5	8.6	6	4.6
18	19.8	8	10.1	9.7	6	5.0
21	23.2	9	12.0	10.5	6	5.4

4.2 Discussions

4.2.1 Table 4.1 the result of the water quality analysis.

The water sample had a pH of 8.10, indicating slight alkalinity, within the optimal irrigation range of 6.5–8.5 recommended by FAO (2017). Nitrogen content (0.079%) was trace, as expected, since irrigation water rarely contributes significant nitrogen compared to organic fertilizers (Olayinka*and*Ojediran, 2020). Sodium (1.72 mg/L), potassium (0.35 mg/L), calcium (0.48 mg/L), and iron (0.315 mg/L) were in acceptable ranges for irrigation water (Ayeni *et al.,* 2019). Lead content (0.475 mg/L) was slightly elevated, consistent with Eze et al. (2018), who reported trace heavy metal contamination in water sources near agricultural areas. Toxic elements such as cadmium and chromium were absent, indicating suitability for composting and irrigation.

4.2.2 Table 4.2 Laboratory Test Results for Poultry Droppings

The poultry droppings had a moisture content of 52.02%, consistent with Hassan et al. (2020), who reported typical ranges of 50–55%, supporting microbial activity during composting. The pH (8.41) confirmed alkalinity, which aids organic matter breakdown (Bolan *et al.,* 2010). Total nitrogen (3.577%) and available phosphorus (11.688%) were high, confirming poultry manure as a nitrogen- and phosphorus-rich material that enhances soil fertility, as also found by Onwudike et al. (2020).

The C:N ratio (2.092%) was lower than the ideal composting range (20–30:1), meaning it requires mixing with high-carbon materials like sawdust to avoid nitrogen loss through ammonia volatilization (Adewale*and*Lawal, 2018). Bulk density (1.715 g/cm^3) and porosity (2.260) indicated good physical structure for composting.

4.2.3 Table 4.3 Nutrient Content of Poultry Droppings

The nutrient profile showed crude protein (9.96%), carbohydrate (29.31%), and fat (2.12%), suggesting a balanced composition. Crude protein levels were higher than those reported by Adediran et al. (2019), indicating superior nitrogen availability. The ash content (3.90%) reflected mineral reserves beneficial for soil enrichment, and the calorific value (176.42 kcal/100 g) showed energy content that enhances microbial decomposition (Adeleke *et al.,* 2019).

These properties confirm poultry manure's efficacy as a nutrient source in compost, supporting findings by Nwite et al. (2018).

4.2.4 Table 4.4 Laboratory Test Results for Sawdust

Sawdust had low nitrogen (0.311%) and a high C:N ratio (85.93), typical of carbonaceous bulking agents (Olaniyan *et al.,* 2020). This property justifies its combination with nitrogen-rich poultry manure to balance composting reactions and minimize nitrogen losses. The pH (6.54) was mildly acidic, complementing the alkalinity of poultry droppings for optimal composting.

Moisture content (13.89%) was adequate for storage stability, while bulk density (0.881 g/cm³) and porosity (0.439) favored aeration in compost piles. Electrical conductivity (7524 μS/cm) and total dissolved solids (3757 mg/L) were relatively high, consistent with Adeniyi et al. (2021), indicating the presence of soluble organic compounds.

4.2.5 Table 4.5 Nutrient Content of Sawdust

The sawdust had very low crude protein (0.96%) and ash content (2.42%), confirming its nutrient-poor nature compared to poultry manure. However, the carbohydrate content (79.07%) and calorific value (336.56 kcal/100 g) were high, providing carbon and energy for microbial growth (Eze *et al.,* 2018). Its dry matter content (85.71%) exceeded that of poultry manure, supporting its use as a stable bulking agent (Adeniyi *et al.,* 2021).

4.2.6 Table 4.6 Vegetable Growth Performance

Amaranthus plants grown in soil amended with the poultry-droppings-and-sawdust compost exhibited higher stem height (23.2 cm vs. 6.0 cm), number of leaves (9 vs. 6), and leaf length (12.0 cm vs. 5.4 cm) after 21 days compared to the control. These results demonstrate significant improvement in vegetative growth, corroborating Ogunlela et al. (2019), who reported that poultry manure enhances nitrogen availability for leafy vegetables.

Measurement methods: Plant height was measured with a ruler from the soil surface to the apical bud; leaf number was counted manually; and leaf length was measured along the midrib. Harvesting was done at 21 days by cutting at soil level. Fresh biomass yield was determined using an electronic scale, showing that the manure-treated plants produced approximately 2.8 times more biomass than untreated plants.

The observed growth enhancement is attributed to the nutrient-rich poultry droppings balanced with sawdust's carbon content, which improved soil aeration and microbial activity. Similar findings were reported by Akanbi et al. (2020), who observed increased yield in *Amaranthus* when composted poultry manure was applied.

4.3 Comparison the results with existing research

The findings align with prior studies showing that poultry manure enhances nitrogen and phosphorus availability, promoting vegetative growth in leafy vegetables (Ogunlela *et al.,* 2019). The observed low C:N ratio in poultry droppings agrees with Onwudike et al. (2020), who recommended co-composting with carbon-rich materials to minimize nitrogen losses.

Similarly, sawdust’s high C:N ratio and carbohydrate content match Olaniyan et al. (2020), who identified sawdust as an effective bulking agent that improves aeration and compost stability. The synergy of poultry manure and sawdust observed here is consistent with Adeniyi et al. (2021), who found that co-composting nitrogen-rich and carbonaceous materials results in high-quality compost with balanced nutrient release.

The yield improvement in *Amaranthus* supports Akanbi et al. (2020), who reported significant biomass increases when poultry-manure-based compost was used for leafy vegetables. These results confirm that co-composted poultry droppings and sawdust can sustainably enhance soil fertility and crop productivity

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study focused on the production of organic manure by combining poultry droppings and wood droppings (sawdust) for vegetable farming. The experimental site was located at Kwara State Polytechnic farm, Akwo Village. Laboratory tests were conducted on individual components (water, sawdust, and poultry droppings) to evaluate their physical and chemical properties. Results show poultry droppings are rich in nitrogen, phosphorus, and organic matter, while sawdust serves as a carbon-rich additive. The balance of these components produced a compost with improved structure, aeration, and nutrient profile suitable for vegetable growth.

The combination of poultry droppings and wood droppings has been proven effective in producing quality organic manure. The manure showed desirable nutrient composition, improved soil amendment characteristics, and potential to enhance vegetable growth. This method provides a sustainable approach to organic waste recycling and offers an environmentally friendly alternative to chemical fertilizers.

5.2 Recommendations

1. Farmers should adopt the use of poultry droppings and sawdust compost for vegetable production to reduce dependence on synthetic fertilizers.
2. Further research can be carried out to optimize composting time and evaluate the effect on specific vegetable types.
3. Government and agricultural agencies should support organic manure production through training and subsidized equipment.

4. Awareness campaigns should be launched to promote the environmental and economic benefits of organic fertilizers.
5. Regular monitoring of heavy metals and pH levels in compost should be encouraged to ensure soil and crop safety.

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