

# Effects of Rapid Organic Manure Fertilization on The Growth and Yield of Cabbage (*Brassica Oleracea L.*) In Anyigba, Kogi State Nigeria

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## Abstract

The study was conducted at Prince Abubakar Audu University Student Research and Demonstration Farm, Anyigba, during the 2024 farming season. The main objective of the study is to evaluate the impact of organic manure on vegetable (cabbage) production in Anyigba. The experiment was laid in a randomized complete block design (RCBD) with four (4) replicates. Treatments consisted of two (2) poultry manure (4 and 8 tons per ha), two (2) pig slurry (4 and 8 tons per ha), a combination of both with internal each of 4 tons with a control (0 tons) respectively. From the results obtained, it is clearly that Cabbage (*Brassica oleracea L.*) was significantly ( $p < 0.05$ ) influence by the application of Organic Manure. Poultry Manure (4t) + Pig Slurry (4t) plot significantly produced the tallest plant, at 2 and 4 Weeks after transplanting with mean value of (4.00 and 13.30) while at 6, 8, 10 WAT 8 t/ha Poultry Manure gave the Tallest plant with mean value of 20.13, 20.47 and 5.67. The highest number of leaves was obtained from 8 t/ha Poultry Manure with mean value of 5.67, 12.00, 12.67, 14.17 and 14.83 at 2, 4, 6, 8 and 10 WAT. The application of 8 tonnes per hectare of poultry manure significantly ( $P < 0.05$ ) produced the highest yield of (59.33 t/ha). Organic manure provided plants with sufficient nutrients to facilitate the synthesis of certain metabolites and enzymes resulting in increased yields.

## Introduction

Consumer awareness of food safety issues and environmental issues has contributed to the growth of organic agriculture in recent years [1]. Organic manure cultivation is also gaining importance due to its low chemical residue content and excellent taste [2]. Organic cabbage production, or any commodity, relies on management strategies that replenish and maintain the perennial fertility of the soil to provide optimal conditions for ecosystem activity Cabbage is an important vegetable that is widely consumed worldwide. [3]. The origin of the cabbage is unclear; However, it is attributed to the southwest coast of Europe or the eastern Mediterranean, Asia Minor, or ancient Greece [4] According to [5, 6], the crop was first cultivated in the Netherlands in the fall fourteenth century, it later spread to other European and Mediterranean countries in Africa was introduced by European

colonists [7]. The most popular vegetable in the world in terms of location, production and availability, almost year-round, it holds pride of place in the cole crop for its sweet taste, flavor and nutritional value Used as vegetables, raw foods, often preserved as sauerkraut or cultivation of roasted roots. Cabbage is a good source of vitamin C, some B vitamins, potassium and calcium [8]. Cabbage is commonly grown in Nigeria and consumed mostly raw and ground by humans for vitamin and mineral nutrition which is widely grown in the Northern regions and cabbage production increased from 2.7 million to 14.3 million tonnes. In Nigeria, large quantities of animal waste are produced and piled up in landfills, threatening the environment. The incorporation of these wastes into soil for crop production is expected to be beneficial as most Nigerian soils are low in organic matter, which is essential for soil fertility and primary and secondary micronutrient availability two crop production Several studies conducted during high yield

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years failed to penetrate [9] show positive effects of organic manure on soil fertility, crop growth and yield so [10].

Replenishing and maintaining soil organic matter through the use of animal manure, by [11] inhibits soil life and storage of plant nutrients especially nitrogen, phosphorus, potassium and micronutrients and control nutrient absorption effectively. The nutrients in organic fertilizers are released more slowly and retained in soil for longer to ensure longer residue effect, improved rooting and higher crop yield [12]. Food security and sustainable crop production by smallholder producers are increasingly dependent on organic fertilizers as an alternative to organic production do not contain Organic fertilizers can be used to reduce the amount of toxins (nitrates etc.) produced by synthetic chemicals commonly used in vegetables such as cabbage, therefore, produced Good vegetables and human-health are also improved Little information is available on organic cabbage production [13]. However, information on the utilization of organic manure for cabbage production is scarce, therefore, the impact of organic manure on vegetable (cabbage) production in Anyigba needs further investigation

## Materials and Methods

### Experimental Site

The experiment was conducted in an open field in front of the green house of the faculty of Agriculture, Prince Abubakar Audu University, Anyigba, The location is at Latitude 7°6' N and Longitude 7°43' E.

### Treatments and Experimental Design

The experiment was set up in a randomized complete block design (RCBD) with four (4) replicates. Treatments consisted of two (2) poultry litter bins (4 and 8 tons per ha), two (2) pig manure bins (4 and 8 tons per ha), a combination of both with internal each of 4 tons with a control (0 tons) making a total six (6). Each plot measures 3m by 3m = 9m<sup>2</sup>/plot, making a land size of 15m x 23m = 345m<sup>2</sup>.

### Soil Analysis

The composite soil samples was collected to a depth of 0 - 15cm was air dried, crushed and sieved with 2mm mesh in order to assess the physico-chemical properties of the soil.

### Cultural Practices:

#### Nursery Practices

Cabbage seeds were sown on nursery beds to raise seedlings for transplanting in the field therefore, nursery was carried out in order to raise the seedlings for transplanting, for doing that seed beds of 3m x 1m with 10 - 15 cm in height was raised (prepared). About 1m distance was kept between two beds to carry out intercultural operations such as watering, weeding, etc. The surface of beds was dress smooth and well leveled before

seed sowing.

### Land Preparation

The land for the experiment was ploughed, harrowed and ridged to a fine tilth using a tractor before setting out the field. Pegs, rope and measuring tape was used for the field layout.

### Transplanting

Transplanting was carried out in the morning at spacing of 45cm intra-row by 75cm inter-row spacing. Before transplanting, the roots of the seedlings were dipped in a solution of Bavistin (2g per litre of water). Irrigation was given immediately after transplanting at spacing of 25cm intra-row by 75cm inter-row spacing.

### Weeding

Regular weeding was carried out on a bi-weekly basis (2weeks interval) using the hand hoe to control or suppress the effect of weed.

### Harvesting

Cabbage was ready for harvesting at 90 - 120 days after planting. Harvesting was done promptly when the heads are firm and mature. The heads was harvested by bending it to one side and cut with a knife.

### Parameters:

#### Plant Height (cm)

This was determined by measuring the plant from ground level to the tip and recorded.

#### Numbers of Leaves/Plant

This was obtained by counting each green and functional leaf that existed on the plant at each sampling time.

#### Yield Parameters:

##### Days to 50% Head Initiation

The number of days from planting to when 50% of a plot initiated head was counted observed and recorded.

##### Diameter of Head (cm)

The head diameter of the tagged plant was measured and were determine.

##### Weight of Head (kg)

The head from three tagged plants were weighed at harvest and average was taken.

##### Head Weight (t/ha)

The head harvested from each plot was weighed and recorded using weighing scale. And this was estimated to tones per hectare

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## Data Analysis

Data collected was subjected to analysis of variance (ANOVA) for Randomized Complete Block Design (RCBD) and significantly different means were separated using FSLD at  $P \geq 0.005$  using Statistical Tools for Agricultural Research (STAR, 2013).

## Results and Discussion

### Physico-Chemical Analysis Results

The physicochemical properties as shown in the table below indicate that the soil is of sandy loam textural class and slightly acidic with a pH of 4.50. It had an organic matter content of 1.87% and organic carbon of 1.05%. The N, Mg and K contents were 0.22%, 0.19mg kg<sup>-1</sup> and 1.10cmol kg<sup>-1</sup> respectively the result from this Table 1: indicates that the soil can support the growth of the cabbage (*Brassica oleracea L.*).

### Effects of Rapid Organic Manure Fertilization on the Growth and Yield of Cabbage (*Brassica Oleracea L.*):

#### Plant Height (cm)

The mean height produced per plant of cabbage as influenced by organic manures and rates (poultry manure and pig slurry rates) is presented in Table 2. The result indicates significant effect ( $P < 0.05$ ) of organic manures and its rates on the height produced per plant of cabbage throughout the period of sampling (2, 4, 6, 8 and 10 week after transplanting). At 10<sup>th</sup> weeks after transplanting, the tallest plant (20.47 cm) was recorded with application of 8 tonnes per hectare of poultry manure followed with (20.33 cm) from plants treated with the combination of 4 tonnes of poultry manure + 4 tonnes of pig slurry plot meanwhile, the shortest plant (15.60 cm) was recorded from the control plot.

#### Number of Leaves/Plant

Table 2, the result indicates significant effect ( $P < 0.05$ ) of poultry manure and pig slurry rates on the number of leaves produced per plant throughout the period of sampling (2, 4, 6, 8 and 10 weeks after transplanting). At 10<sup>th</sup> weeks after transplanting, the tallest plant (14.83) was recorded with application of 8 tonnes per hectare of poultry manure followed by the plants treated with the combination of 4 tonnes of poultry manure + 4 tonnes of pig slurry per hectare with value of (14.67). while the least number of leaves per plant (11.82) was recorded from the control plot.

#### Days to 50% Head Initiation

The average days to 50% head initiation observed per plot of cabbage in relation to organic manures and rates (poultry manure and pig slurry rates) is presented in table 3. The result indicates significant effect ( $P < 0.05$ ) of poultry manure and pig slurry rates on days to 50% head initiation per plot of cabbage. Plot treated with 8 tonnes per hectare of poultry manure was the first to reach 50% head initiation at (61.33) days after transplanting followed

by plot treated with combination of 4 tonnes of poultry manure + 4 tonnes of pig slurry per hectare on the 62.67<sup>th</sup> days after transplanting and the last to reach 50% head initiation was the control plot.

#### Diameter of Head (cm)

The mean head diameter produced per plant of cabbage in relation to organic manures and rates (poultry manure and pig slurry rates) is presented in table 3. The result indicates significant effect ( $P < 0.05$ ) of poultry manure and pig slurry rates on the head diameter produced per plant. The widest head (9.10 cm) was recorded for plant treated with 8 tonnes per hectare of poultry manure followed by (9.07) from plant treated with the combination of 4 tonnes of poultry manure + 4 tonnes of pig slurry per hectare and the smallest head (7.13) was recorded from the control plot.

#### Weight of Head (kg)

The average head weight produced per plant of cabbage in relation to organic manures and rates (poultry manure and pig slurry rates) is presented in table 4. The result indicates significant effect ( $P < 0.05$ ) of poultry manure and pig slurry rates on the head weight produced per plant of cabbage. The highest head weight (2.87 kg) was recorded for plant treated with 8 tonnes per hectare of poultry manure followed by (2.85 kg) from plant treated with combination of 4 tonnes of poultry manure + 4 tonnes of pig slurry per hectare and the least head weight (2.00 kg) was recorded from the control plot.

#### Total Yield (t/ha)

The total yield produced per hectare of cabbage as influence by organic manures and rates (poultry manure and pig slurry rates) is presented in table 4. The result indicates significant effect ( $P < 0.05$ ) of poultry manure and pig slurry rates on the total head yield produced per hectare of cabbage. Application of 8 tonnes per hectare of poultry manure significantly ( $P < 0.05$ ) produced the highest yield of (59.33 t/ha) which was not statistically different from the combined treatment and 8 tonnes per hectare of pig slurry that produced (58.83 and 55.67 t/ha) respectively. Meanwhile, the least yield was observed in the control.

## Discussion

From the results obtained from this study, it is clearly that Cabbage (*Brassica oleracea L.*) was significantly affected by the application of Organic Manure (Poultry Manure and Pig Slurry). Various growth and yield parameters were observed including: Plant height, number of leaves per plant, days to 50% head initiation, diameter of head, weight of Head and head yield. When Poultry Manure (4t) + Pig Slurry (4t) plot significantly produced the tallest plant, at 2 and 4 Weeks after transplanting with mean value of (4.00 and 13.30) while at 6, 8, 10 Weeks after transplanting 8 t/ha Poultry Manure gave the Tallest plant with mean value of 20.13, 20.47 and 5.67. Compared to manure

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**Table 1:** Physico-chemical properties of soil

Soil Characteristics	Value
P <sup>H</sup> (H <sub>2</sub> O)	4.50
P <sup>H</sup> (CaCl)	4.38
%Organic carbon	1.053
%Organic matter	1.87
%Total N	0.054
Available P ppm	10.33
Ca (cmol/kg)	0.267
K (cmol/kg)	1.102
N (cmol/kg)	0.222
Mg (cmol/kg)	0.19
% Sand	75
% Silt	8
% Clay	17
Textural Class	Sandy Loam

mixtures applied to agricultural land, the treatment showed that organic manure mixtures enhanced soil carbon, nitrogen, phosphorus and potassium, and accelerated plant growth. According to (14). The results of the experiment partially support the findings of (15). The application of 8 tonnes per hectare of poultry manure significantly ( $P < 0.05$ ) produced the diameter of head (9.10cm), weight of head (2.87kg) and highest yield of (59.33 t/ha). It might be due to increased metabolic activities resulting higher metabolite accumulation and proper head formation

## Field analysis 2024

**Table 2:** Effects of Rapid Organic Manure Fertilization on the Growth and Yield of Cabbage (*Brassica Oleracea L.*) on Plant height (cm) and number of leaves produced per plant

Treatments	Plant height (cm)					Number of Leaves				
	Sampling Periods (Weeks After Transplanting)									
	2WAT	4WAT	6WAT	8WAT	10 WAT	2WAT	4WAT	6WAT	8WAT	10 WAT
0t/ha	2.85 <sup>d</sup>	9.93 <sup>d</sup>	13.10 <sup>d</sup>	15.10 <sup>c</sup>	15.60 <sup>c</sup>	3.67 <sup>b</sup>	8.17 <sup>d</sup>	9.17 <sup>d</sup>	11.15 <sup>d</sup>	11.82 <sup>c</sup>
4t PM/ha	3.23 <sup>cd</sup>	11.33 <sup>bc</sup>	15.80 <sup>b</sup>	17.73 <sup>c</sup>	18.00 <sup>c</sup>	5.11 <sup>a</sup>	10.83 <sup>b</sup>	11.50 <sup>b</sup>	13.00 <sup>c</sup>	13.67 <sup>b</sup>
8t PM/ha	3.97 <sup>ab</sup>	13.27 <sup>ab</sup>	17.93 <sup>a</sup>	20.13 <sup>a</sup>	20.47 <sup>a</sup>	5.67 <sup>a</sup>	12.00 <sup>a</sup>	12.67 <sup>a</sup>	14.17 <sup>a</sup>	14.83 <sup>a</sup>
4t PS/ha	3.17 <sup>d</sup>	10.87 <sup>c</sup>	14.70 <sup>c</sup>	16.23 <sup>d</sup>	16.57 <sup>d</sup>	5.00 <sup>a</sup>	9.33 <sup>c</sup>	10.27 <sup>c</sup>	12.67 <sup>c</sup>	13.50 <sup>b</sup>
8t PS/ha	3.60 <sup>bc</sup>	11.73 <sup>b</sup>	15.94 <sup>b</sup>	18.37 <sup>b</sup>	18.93 <sup>b</sup>	5.67 <sup>ab</sup>	11.00 <sup>b</sup>	11.62 <sup>b</sup>	13.60 <sup>b</sup>	14.47 <sup>a</sup>
PM (4t) + PS (4t)	4.00 <sup>a</sup>	13.30 <sup>a</sup>	17.40 <sup>ab</sup>	20.00 <sup>ab</sup>	20.33 <sup>ab</sup>	5.67 <sup>ab</sup>	11.93 <sup>ab</sup>	12.67 <sup>a</sup>	14.00 <sup>ab</sup>	14.67 <sup>ab</sup>
Significance	*	*	*	*	*	*	*	*	*	*
LSD (0.05%)	0.38	0.75	0.93	0.38	0.73	0.66	0.87	0.91	0.44	0.53

Means having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level of probability. LSD- Least Significant Difference. P.M- Poultry Manure, PS- Pig Slurry

that lead to increase diameter of head, weight of head per plant and head formation and maturity by applying mixed organic manures treatment as compared to control. These findings are in accordance with (16) who reported that both testing and growth of weight of head occurrence. The experiment also supports the findings of (17). Similarly, the increase in organic manure provided plants with sufficient nutrients to facilitate the synthesis of certain metabolites and enzymes resulting in increased yields. This factor is taken up by other researchers for cabbage the production is consistent (18, 19). The findings are very close to those of (20)

## Conclusion and Recommendation

From the study, the following conclusion was made:

Applications of organic manure significantly affect the growth and yield of cabbage, however, the application of 8 t/ha of poultry manure and the combine applications made major influence on the cabbage production. Applications of Poultry Manure (4t) + Pig Slurry (4t) plot significantly produced the tallest plant, at 2 and 4 Weeks after transplanting with mean value of (4.00 and 13.30) while at 6, 8, 10 Weeks after transplanting 8 t/ha Poultry Manure gave the Tallest plant with mean value of 20.13, 20.47 and 5.67. The highest number of leaves was obtained from 8 t/ha Poultry Manure with mean value of 5.67, 12.00, 12.67, 14.17 and 14.83 at 2, 4, 6, 8 and 10 Weeks after transplanting. Similarly, the control plot produced the shortest plant, lowest number of leaves and longer duration for head initiation. The application of 8 tonnes per hectare of poultry manure significantly ( $P < 0.05$ ) produced



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**Table 3:** Effects of Rapid Organic Manure Fertilization on the Growth and Yield of Cabbage (*Brassica Oleracea L.*) on Days to 50% Head Initiation and Diameter of Head (cm)

Treatments	Days to 50% Head Initiation	Diameter of Head (cm)
0t/ha	69.00 <sup>a</sup>	7.13 <sup>e</sup>
4t PM/ha	64.67 <sup>bc</sup>	8.07 <sup>c</sup>
8t PM/ha	61.33 <sup>d</sup>	9.10 <sup>a</sup>
4t PS/ha	66.33 <sup>b</sup>	7.47 <sup>d</sup>
8t PS/ha	65.00 <sup>bc</sup>	8.30 <sup>b</sup>
PM (4t) + PS (4t)	62.67 <sup>cd</sup>	9.07 <sup>ab</sup>
Significance	*	*
LSD (0.05%)	2.58	0.19

Means having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level of probability. LSD- Least Significant Difference. P.M- Poultry Manure, PS- Pig Slurry

**Table 4:** Effects of Rapid Organic Manure Fertilization on the Growth and Yield of Cabbage (*Brassica Oleracea L.*) on Weight of Head (kg) and Head Yield (t/ha)

Treatments	Weight of Head (kg)	Head Yield (t/ha)
0t/ha	2.00 <sup>e</sup>	44.33 <sup>d</sup>
4t PM/ha	2.43 <sup>c</sup>	53.67 <sup>b</sup>
8t PM/ha	2.87 <sup>a</sup>	59.33 <sup>a</sup>
4t PS/ha	2.20 <sup>d</sup>	50.67 <sup>c</sup>
8t PS/ha	2.62 <sup>b</sup>	55.67 <sup>b</sup>
PM (4t) + PS (4t)	2.85 <sup>ab</sup>	58.83 <sup>ab</sup>
Significance	*	*
LSD (0.05%)	0.15	3.72

Means having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level of probability. LSD- Least Significant Difference. P.M- Poultry Manure, PS- Pig Slurry

the highest yield of (59.33 t/ha) which was not statistically different from the combined treatment and 8 tonnes per hectare of pig slurry that produced (58.83 and 55.67 t/ha) respectively. Meanwhile, the least yield was observed in the control. Therefore, the use of 8 t/ha of poultry manure for optimum production of cabbage for Anyigba farmers since there is no much availability of pig slurry in the environment for combination of manure for optimum production is recommended.

## Conflicts of interest

None

## Funding

None

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