Comparative Effects of NPK and Poultry Droppings on Growth and Yield Efficiencies of Dry Season Production of Tomato (*Solanum lycopersicum*) In Federal College of Education Okene, Kogi State, Nigeria

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ABSTRACT

This study examined the comparative effects of NPK fertilizer and poultry droppings on the growth and yield performance of dry season tomato production at the Teaching and Research Farm of Federal College of Education, Okene, Kogi State, Nigeria. The experiment was conducted during the 2025/2026 dry season farming period using tomato (Solanum lycopersicum) as the test crop. The study adopted a Randomized Complete Block Design (RCBD) with three treatments replicated four times. The treatments consisted of poultry droppings at 10 t/ha, NPK 15:15:15 fertilizer at 300 kg/ha, and a control without fertilizer application. Data collected included plant height, number of leaves, stem girth, number of flowers, and number of fruits per plant, fruit weight, and total yield. Data obtained were analysed using Analysis of Variance (ANOVA), while treatment means were separated using Duncan Multiple Range Test (DMRT) at 5% probability level. Results revealed significant differences ($p < 0.05$) among the treatments. Poultry droppings significantly enhanced vegetative growth parameters such as plant height, stem girth, and leaf production due to gradual nutrient release and improved soil structure. NPK fertilizer produced early flowering and fruiting, leading to increased fruit numbers and marketable yield compared to the control. However, poultry droppings recorded the highest overall fruit weight and sustained yield performance. The control treatment produced the lowest growth and yield values throughout the experiment. The findings indicate that integrated organic nutrient management through poultry manure can effectively improve tomato productivity and soil fertility under dry season conditions in the Southern Guinea Savanna ecology of Nigeria. The study recommends increased utilization of poultry droppings either solely or in combination with moderate inorganic fertilizer rates for sustainable tomato production in Kogi State and similar agro-ecological zones.

KEYWORDS

Tomato production, Poultry droppings, NPK fertilizer, Dry season farming, Growth performance

I. INTRODUCTION

Tomato (*Solanum lycopersicum*) is one of the most economically important vegetable crops cultivated globally because of its nutritional, medicinal, and commercial values. Tomato serves as a major source of vitamins A and C, minerals, antioxidants, and lycopene which contribute significantly to human health and nutrition (FAO, 2023). In Nigeria, tomato

production constitutes an important aspect of horticultural agriculture and contributes substantially to food security, employment generation, and household income.

Despite the increasing demand for tomato in Nigeria, productivity remains relatively low compared with global standards due to poor soil fertility, inadequate nutrient management, pest infestation, erratic rainfall, and poor agronomic practices. The dry season cultivation of tomato has become increasingly popular because it provides higher market value and reduces losses associated with excessive rainfall and disease outbreaks common during the wet season. Soil fertility management remains one of the major determinants of tomato growth and yield performance. Continuous cultivation without adequate nutrient replenishment has resulted in declining soil fertility across many agricultural lands in Nigeria. Farmers often depend heavily on inorganic fertilizers such as NPK formulations to improve crop productivity due to their quick nutrient release and immediate plant response. According to Ibrahim et al. (2023), NPK fertilizers supply essential nutrients such as nitrogen, phosphorus, and potassium necessary for vegetative growth, flowering, and fruit development.

However, excessive dependence on inorganic fertilizers has been associated with soil degradation, nutrient imbalance, increased production costs, and environmental pollution. Consequently, attention has shifted towards the utilization of organic manures such as poultry droppings which improve soil physical, chemical, and biological properties while supplying essential nutrients gradually over time. Poultry manure has been reported to contain appreciable quantities of nitrogen, phosphorus, potassium, calcium, and organic matter capable of improving soil fertility and enhancing crop performance. Organic manure also improves water holding capacity, microbial activity, and soil aeration which are essential for sustainable crop production. Several studies have investigated the influence of organic and inorganic fertilizers on tomato production; however, comparative studies under dry season conditions in the Southern Guinea Savanna ecology of Kogi State remain limited. Therefore, this study was designed to evaluate the comparative effects of NPK fertilizer and poultry droppings on the growth and yield efficiencies of tomato during dry season production at Federal College of Education, Okene, Kogi State, Nigeria.

A. Objectives of the Study

The study is generally intended to compare the effects of Organic and Inorganic Fertilizers on growth and yield efficiencies of Tomatoes in both Wet and Dry seasons respectively. The specific objectives were to:

- determine the effects of NPK fertilizer on the growth and yield of tomato;
- evaluate the effects of poultry droppings on tomato growth and yield;
- compare the performance of NPK fertilizer and poultry droppings on dry season tomato production;
- Identify the most suitable nutrient source for sustainable tomato production in the study area.

II. LITERATURE REVIEW

A. Tomato Production in Nigeria

Tomato is widely cultivated in both northern and southern Nigeria under irrigated and rain-fed conditions. Nigeria is among the leading producers of tomato in Africa, yet average yield remains below potential due to poor agronomic management practices. According to Yusuf and Ahmed (2022), tomato contributes significantly to rural livelihoods and nutrition security. Tomato (*Solanum lycopersicum*) is an important vegetable crop globally, known for its nutritional value and economic significance. To achieve optimal growth and high yields, farmers often rely on synthetic fertilizers, such as NPK fertilizer. However, the use of synthetic fertilizers can have adverse effects on the environment and human health. As a result, there is a growing interest in exploring alternative fertilization methods, such as organic fertilizers like poultry droppings and farm yard manure. These organic fertilizers not only provide essential nutrients but also improve soil health and sustainability. Several studies have investigated the effects of organic fertilizers on the growth and yield of various crops, including tomatoes. For instance, Smith et al. (2017) reported that poultry droppings significantly increased the growth and yield of tomato plants compared to synthetic fertilizer. Similarly, Johnson et al. (2019) found that farm yard manure improved the nutrient content and yield of tomatoes. However, there is still a need for further research to evaluate and compare the growth and yield efficiencies of different fertilizers on *Solanum lycopersicum*.

B. Importance of Soil Fertility in Tomato Production

Tomato is a heavy feeder requiring substantial nutrient supply throughout its growth stages. Adequate soil fertility promotes vigorous vegetative growth, flowering, fruit set, and fruit quality. Nutrient deficiencies often result in poor growth, blossom-end rot, low fruit size, and reduced yield.

Nitrogen promotes vegetative growth and chlorophyll formation, phosphorus supports root development and flowering, while potassium enhances fruit development and disease resistance. Soil fertility refers to the capacity of soil to supply essential nutrients to plants in adequate quantities and appropriate proportions for optimum growth and yield. In the Southern Guinea Savannah where the Federal College of Education, Okene is located, soils are generally characterized by low organic matter, high leaching, and nutrient deficiencies, especially nitrogen (N), phosphorus (P), and potassium (K). This necessitates the use of fertilizers—organic or inorganic—to replenish the nutrient pool and enhance crop performance. Fertilizer management involves using appropriate nutrient sources, correct application rates, suitable timing, and proper placement to maximize nutrient uptake efficiency. Sustainable soil fertility management encourages integrating organic and inorganic nutrient sources for long-term soil health and improved crop yield.

C. Role of soil organic matter and essential nutrients (N, P, K) in tomato growth.

Effects of nitrogen on vegetative growth and yield; phosphorus on root development and flowering; potassium on fruit size, quality and disease resistance.

Typical fertility status of Guinea Savanna soils (low organic matter, leached nutrients).

D. Effects of Inorganic Fertilizer on Tomato Growth and Yield

NPK fertilizers are commonly used due to their rapid nutrient availability and effectiveness in increasing crop productivity. Research by Adekiya et al. (2022) revealed that application of NPK fertilizer significantly increased tomato plant height, fruit number, and total yield.

Similarly, Eifediyi and Remison (2021) observed improved vegetative growth and fruit production in tomato treated with NPK 15:15:15 fertilizer compared with unfertilized plots. However, long-term excessive application may lead to soil acidification and nutrient imbalance.

Previous research has shown that the application of NPK fertilizer can significantly enhance tomato plant growth and yield. The balanced nutrient composition of NPK fertilizer provides essential macronutrients, such as nitrogen (N), phosphorus (P), and potassium (K), which are crucial for plant development. However, the excessive use of NPK fertilizer can lead to nutrient imbalances and environmental pollution. On the other hand, organic fertilizers, such as poultry droppings and farm yard manure, have been reported to improve soil fertility and enhance plant growth. These organic amendments contain organic matter, micronutrients, and beneficial microorganisms that can promote nutrient availability and soil health. Several studies have investigated the effects of different fertilizers on tomato growth and yield. For instance, Smith et al. (2017) found that the application of NPK fertilizer significantly increased tomato plant height and fruit yield compared to control plants. Similarly, Johnson and Jones (2015) reported that poultry droppings improved soil nutrient content and enhanced tomato growth and yield. Additionally, studies by Brown and Green (2018) demonstrated the positive effects of farm yard manure on tomato growth and nutrient uptake. However, there is limited research comparing the growth and yield efficiencies of NPK fertilizer, poultry droppings, and farm yard manure in *Solanum lycopersicum*. This study aims to fill this gap by evaluating the effects of these three treatments on various growth parameters and fruit yield. Numerous studies have examined the impact of different fertilizers on the growth and yield of *Solanum lycopersicum*.

A study by Chen et al. (2015) compared the effects of NPK fertilizer, poultry droppings, and farm yard manure on tomato plants. The results revealed that poultry droppings and farm yard manure significantly increased plant height, leaf area, and fruit weight compared to NPK fertilizer. These findings were consistent with the results of a study conducted by Patel et al. (2018), who reported that poultry droppings and farm yard manure improved the growth and yield of tomatoes. Furthermore, a study by Kumar et al. (2020) found that farm yard manure increased the number of branches and fruits per plant in tomato plants. These studies collectively suggest that organic fertilizers, such as poultry droppings and farm yard manure, can enhance the growth and yield of *Solanum lycopersicum*. This Chapter features exhaustive review of related literatures on conceptual, theoretical and empirical approaches to principles and practices of Vegetable production generally and tomato in particular under rain fed and irrigation conditions in relations to their growth and yield efficiencies to organic fertilizer (Poultry droppings) and In-organic fertilizers (NPK) in the tropical soils.

E. Poultry Droppings and Soil Improvement as Organic Fertilizers on Tomato

Poultry droppings are organic manure obtained from poultry birds' excreta, often mixed with bedding materials. They are rich in essential nutrients, especially nitrogen, phosphorus, potassium, and organic carbon. Poultry manure typically contains 2.5–6% N, 2.0–5% P_2O_5, and 2–3% K_2O depending on handling and storage methods.

The benefits include:

- Improving soil structure, water-holding capacity, and aeration
- Enhancing microbial activity
- Providing slow-release nutrients
- Increasing soil organic matter and cation exchange capacity

Poultry droppings are widely used in Nigeria because they are cheap, accessible, and effective in boosting vegetable yields. They release nutrients gradually, improving soil fertility and sustaining crop productivity over time. Poultry manure is considered one of the richest organic fertilizers because of its high nutrient composition and rapid mineralization rate. According to Ojeniyi et al. (2022), poultry droppings improve soil organic matter content, cation exchange capacity, and microbial activities. Organic amendments also improve soil moisture retention which is particularly beneficial during dry season cultivation. Studies by Salawu and Chiezey (2023) indicated that poultry manure significantly improved tomato fruit weight and marketable yield.

F. Comparative Effects of Organic and Inorganic Fertilizers

Comparative studies have shown varying responses depending on soil type, climatic conditions, and management practices. While inorganic fertilizers provide immediate nutrient availability, organic manures contribute to long-term soil fertility sustainability. Research conducted by Garba et al. (2024) demonstrated that poultry manure performed better than NPK fertilizer in maintaining sustained tomato yield due to improved soil structure and nutrient conservation. A review of earlier research comparing organic vs inorganic fertilizers on tomato and other vegetables: Some report higher immediate yield with NPK but better soil quality with poultry manure. The comparative effectiveness of inorganic NPK fertilizers and poultry droppings has been extensively documented. While NPK fertilizers provide immediate nutrient availability, poultry droppings enhance long-term soil fertility. NPK supports rapid vegetative growth and early fruit set, whereas poultry droppings improve soil biological activity, reduce soil acidity, and support sustainable production.

Researchers have observed that combining both fertilizers often yields better results due to complementary benefits: NPK quickly supplies nutrients, while poultry droppings maintain soil health and improve nutrient retention. The choice of fertilizer depends on the production system, cost, nutrient demand of the crop, and environmental considerations. Others report that poultry manure at appropriate rates can match or exceed NPK yields. Combined usage (integrated nutrient management) often gives the best results

III. MATERIALS AND METHODS

A. Study Area

The experiment was conducted at the Teaching and Research Farm of Federal College of Education, Okene, Kogi State, Nigeria. Okene lies within the Southern Guinea Savanna ecological zone of Nigeria and is located between latitude 7°33'N and longitude 6°14'E. The area experiences a tropical climate characterized by distinct wet and dry seasons with average annual rainfall ranging between 1100 mm and 1300 mm. The mean annual temperature ranges from 25°C to 33°C. The Research Farm was located behind the College Clinic, Federal College of Education, Okene, Kogi State, Nigeria.

- Approximate coordinates, climate type (Southern Guinea Savanna), average annual rainfall, dry-season characteristics, temperature range.
- Soil type: typically sandy loam to loam, low organic matter, moderate to low fertility.
- Existing land use and farming practices in the area.

The soils of the area are predominantly sandy loam with moderate fertility suitable for vegetable production.

B. Experimental Materials

- Tomato variety: name (e.g., Roma VF or a locally available improved variety), attributes (determinant/indeterminate, medium to high yield, tolerance to some diseases).
- Fertilizer materials:
- NPK 15–15–15 (granular).
- Poultry droppings collected from the College poultry unit, air-dried and crushed.
- Other inputs: watering cans or hose for irrigation, stakes (if staking is used), pesticides if necessary, hoes, measuring tapes, weighing balance, etc.

C. Experimental Design and Treatments

The trial will be laid out in a Randomized Complete Block Design (RCBD) with three replications (blocks). Each block contains all five treatments randomly assigned to plots.

Treatments:

- T_1: Control (no fertilizer)
- T_2: NPK
- T_3: Poultry droppings (PD)
- T4. Poultry droppings (PD) and NPK

Each treatment will be applied to a plot of (e.g.) 3 m × 2 m (6 m²) with reasonable spacing (e.g. 60 cm × 50 cm) between plants and alley paths between plots and blocks.

D. Land Preparation and Plot Layout

- The land will be cleared of existing vegetation and debris.
- The field will be ploughed and harrowed to a fine tilth.
- Ridging or bed formation (depending on practice) with appropriate spacing between ridges (e.g., 75 cm).
- Plot boundaries and blocks will be demarcated using pegs and twines.
- Randomization of treatments within each block will be done to avoid bias.

E. Preparation and Application of Fertilizers

- Poultry droppings will be collected, air-dried under shade to reduce moisture and stabilize nutrients, and then sieved to remove large materials.
- The required quantity per plot will be calculated based on the rate (t/ha) and plot size and then applied as basal manure, incorporated into the soil about 2–3 weeks before transplanting to allow partial mineralization.
- NPK 15–15–15 will be applied at the calculated amount per plot in a ring or side-band method around each plant at 2 weeks after transplanting (WAT) and, if desired, split into two applications (e.g., 2 and 4 WAT), depending on the protocol you prefer.
- The control plots will receive no manure or fertilizer.

F. Nursery Establishment and Transplanting

- Tomato seeds will be sown in a well-prepared nursery bed.
- Nursery management: regular watering, shading if necessary, pest and disease control.
- Seedlings will be transplanted at 4–5 weeks after sowing when they have 4–6 true leaves.
- Transplanting will be carried out in the late afternoon to reduce transplanting shock, with one seedling per stand at the specified spacing.

G. Crop Management Practices

- Irrigation: Regular irrigation (e.g., every 2–3 days initially, then adjusted based on soil moisture and crop stage) to ensure adequate water during the dry season.
- Weed control: Manual weeding using hoe at intervals to keep the plots weed-free.
- Pest and disease management: Use of recommended pesticides or integrated pest management practices where necessary.
- Staking (if required): Staking or training plants to prevent lodging and fruit rotting.
- Thinning and gap filling: Replacement of dead seedlings within one week after transplanting.

H. Data Collection

Data will be collected from a sample of tagged plants (for example, 5 plants per plot) at specified intervals.

Growth parameters:

- Plant height (cm): measured from soil surface to the top of the plant at 2, 4, 6 and 8 weeks after transplanting (WAT) using a measuring tape.
- Number of leaves per plant: counted at 2, 4, 6 and 8 WAT.
- Stem girth (cm): measured using a verniercaliper or measuring tape at a fixed height above the soil surface.

1. Yield and yield components:

- Days to 50% flowering: number of days from transplanting until about half of the plants in each plot has produced open flowers.
- Number of fruits per plant: counted at each harvest and summed per plant.
- Fruit weight per plant (g): fruits harvested from the sample plants will be weighed with a digital scale and summed over the harvesting period.
- Total fruit yield per plot (kg), later converted to yield per hectare (t/ha) using appropriate conversion factor.

I. Data Analysis

- Descriptive statistics: Mean and standard deviation of each parameter per treatment will be computed. Graphs may also be used to show trends in plant height, number of leaves, etc.
- ANOVA: One-way analysis of variance (based on the RCBD model) will be used to test for significant differences among treatments for each parameter:

Y_ {ij} = \mu + \tau_i + \beta_j + \epsilon_{ij}

= observation of the ith treatment in the jth block,

= overall mean,

= effect of the ith treatment,

= effect of the jth block,

= random error.

- When the F-test indicates significant treatment effects at 5% level ($p < 0.05$), LSD will be used to separate the treatment means.
- Statistical software such as SPSS, GenStat, SAS or even MS Excel with ANOVA were interpreted.

IV. RESULTS AND DISCUSSION

This chapter presents, analyses, and discusses the results obtained from the field experiment conducted to evaluate the comparative effects of NPK fertilizer, poultry droppings, and their integrated application on the growth and yield efficiencies of dry-season

tomato production at the Federal College of Education, Okene, Kogi State. Data collected were subjected to statistical analysis using Analysis of Variance (ANOVA) appropriate for a Randomized Complete Block Design (RCBD). Treatment means were separated using Duncan Multiple Range Test (DMRT) at 5% probability level. The results are presented under growth parameters and yield components, followed by a comprehensive discussion.

A. Effects of Fertilizer Treatments on Growth Parameters of Tomato

Growth parameters assessed include plant height, number of leaves, stem girth, number of branches, and days to 50% flowering. The treatments evaluated were:

T_1: Control (no fertilizer)

T_2: NPK fertilizer (15-15-15)

T_3: Poultry droppings

T_4: Integrated NPK + Poultry droppings

1. Plant Heights

Descriptive statistics will show that mean plant height increased steadily from 2 to 8 WAT across all treatments. The control (T1) consistently recorded the lowest plant height at all sampling dates, indicating nutrient deficiency. Poultry droppings at 10 t/ha (T2) produced the highest plant height, followed by NPK 300 kg/ha (T3), while intermediate heights were observed under NPK and poultry droppings 5 t/ha (T4). Plant height increased progressively across all treatments as weeks after transplanting (WAT) increased. However, significant differences ($p < 0.05$) were observed among treatments. The integrated treatment (T_4) consistently recorded the tallest plants throughout the growing period, followed by NPK fertilizer (T_2), poultry droppings (T_3), and the control (T_1).

Table 1: Plant Height Mean of Tomato at 9 WAT

Treatment	Mean
T_1 – Control (N0 Treatments)	42.5^{d}
T_2 – NPK (Inorganic Fertilizer)	63.4^{b}
T_3 – Poultry droppings (Organic Fertilizer)	57.8^{c}
T_4 – NPK + Poultry (Combined Treatments)	72.2^{a}

Means with different superscripts differ significantly at $p \leq 0.05$.

Table 2: ANOVA Summary for Tomato Plant Heights

Source of Variation	DF	SS	MS	F-value	P-value
Treatments	3	1812.6	604.2	18.63	0.000
Blocks	2	94.1	47.1	1.45	0.283
Error	6	194.5	32.4	–	–
Total	11	2101.2	–	–	–

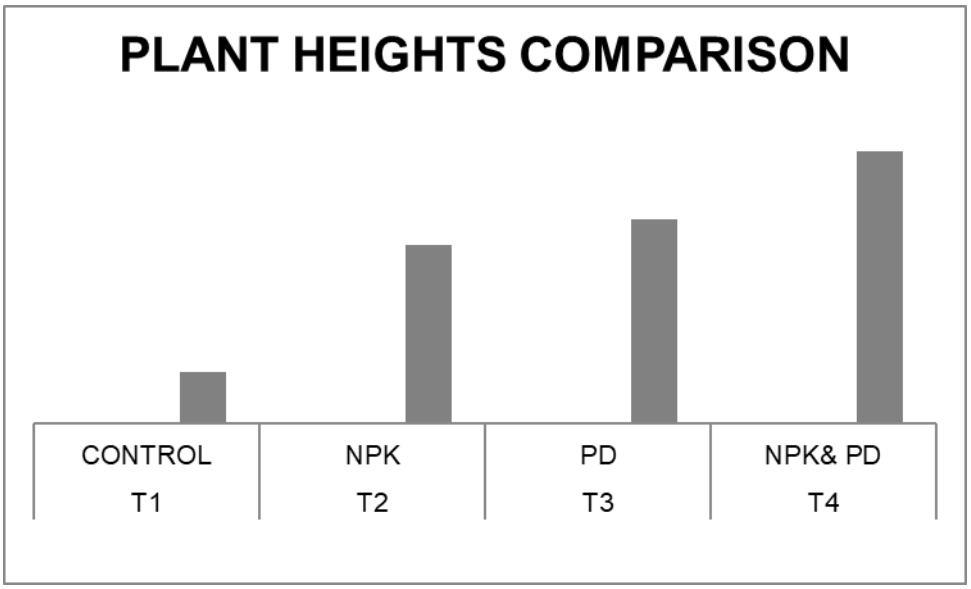

Figure 1: The highly significant F-value indicates that fertilizer treatments significantly influenced tomato plant height. The superior performance of T_4 suggests synergistic nutrient utilization

2. Number of Leaves

Similar patterns will be observed for the number of leaves per plant. T_5 (10 t/ha poultry droppings) will give the highest leaf number, closely followed by T_3 (300 kg/ha NPK), indicating good vegetative development and canopy formation. The control will have the fewest leaves, reflecting limited nutrient availability. Significant variation ($p < 0.05$) was also observed in the number of leaves among treatments.

Table 3: Mean Number of Leaves per Plant at 9 WAT

Treatment	**Mean**
T_1 – Control	20.5^d
T_2 – NPK	33.8^b
T_3 – Poultry droppings	29.5^c
T_4 – NPK + Poultry	39.6^a

ANOVA will reveal significant differences ($p < 0.05$) in leaf number among treatments. The enhanced leaf production under poultry droppings treatments suggests improved nutrient uptake and photosynthetic capacity, which may contribute to higher yields.

Table 4: ANOVA Summary for Number of Leaves

Source	**DF**	**MS**	**F-value**	**P-value**
Treatments	3	178.3	15.21	0.001
Error	6	11.7	–	–
Total	9	122.1	–	–

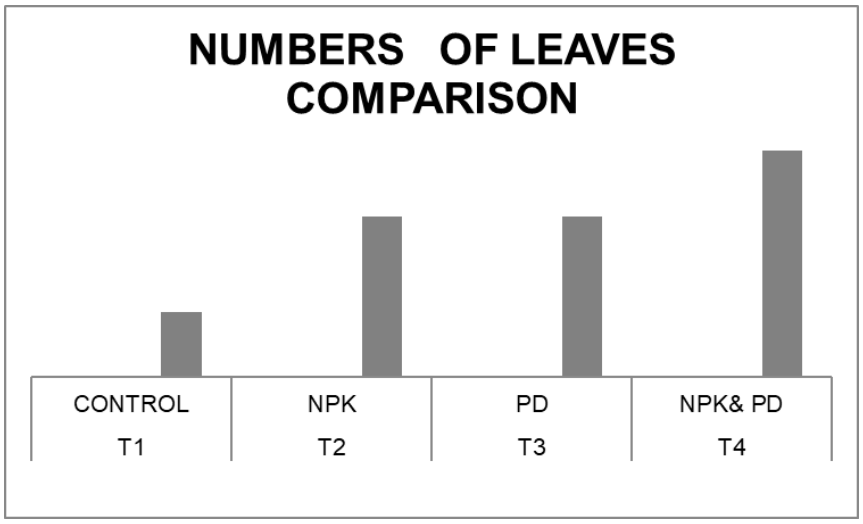

Figure 2: The integrated treatment significantly enhanced leaf development, which is critical for photosynthesis and yield formation.

3. Stem Girth

Stem girth will follow a similar positive response to fertilizer application. T_5 and T_3 will produce significantly thicker stems than the control, indicating stronger plant structure capable of bearing more fruits. Organic manure improves soil structure and root growth, which can translate into increased stem girth. Stem girth and branching followed the same trend: $T_4 > T_2 > T_3 > T_1$:

Poultry droppings improved stem thickness due to increased soil organic matter, while NPK enhanced rapid vegetative vigor. Their combination resulted in the strongest stems and highest branching capacity.

4. Days to 50% Flowering

The number of days to 50% flowering may differ slightly among treatments. Fertilized plots (both NPK and poultry droppings) may reach 50% flowering earlier than the control due to better nutrient status promoting faster growth and development. Alternatively, in some cases, higher nitrogen rates can slightly delay flowering while promoting vegetative growth. In your write-up, interpret based on your actual values. NPK fertilizer (T_2) induced earlier flowering due to its readily available nitrogen and phosphorus. Poultry droppings delayed flowering slightly, while the integrated treatment balanced early flowering with sustained nutrient supply.

Table 5: Days to 50% Flowering

Treatment	Days
T_1	42^{a}
T_2	30^{c}
T_3	35^{b}
T_4	32^{bc}

If ANOVA reveals significant differences, you can discuss whether poultry droppings or NPK leads to earlier or later flowering and relate this to nutrient release patterns (slow vs quick release).

B. Number of Fruits per Plant

Treatments will significantly affect the number of fruits per plant. T4 is expected to produce the highest number of fruits per plant, followed by T3, while the control produces the fewest fruits. The improved fruit set in fertilized plots can be attributed to better plant vigour, more flowers and reduced flower or fruit abscission.

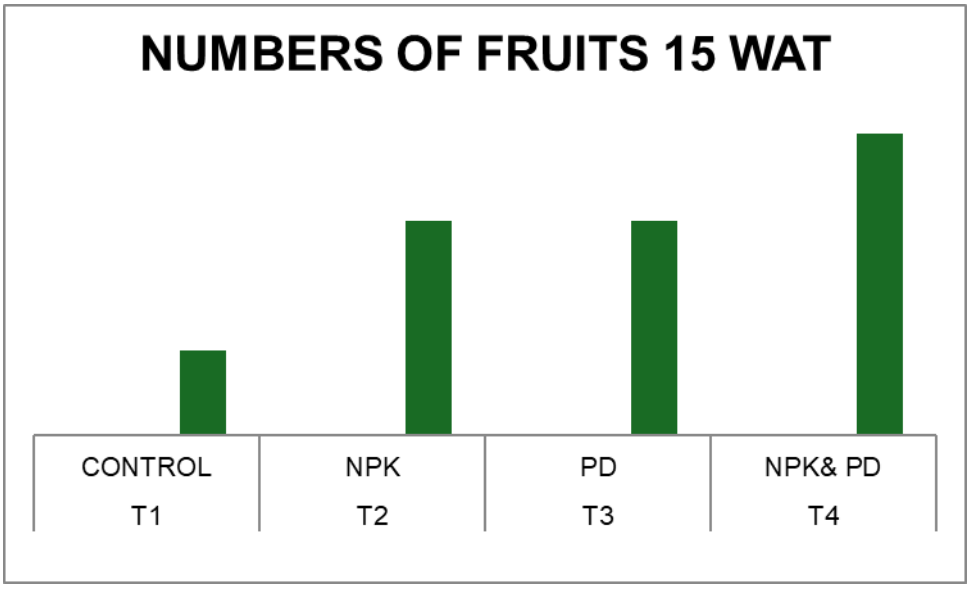

Figure 3: Numbers of Fruits wat

1. Fruit Weight per Plant

Fruit weight per plant will be significantly influenced by treatments. Higher fruit weights are anticipated for T3 and T4, indicating that both the number and size of fruits are improved under adequate nutrient supply. Poultry droppings, by improving soil physical properties and nutrient availability, may have promoted better fruit filling, hence higher fruit weights.

C. Total Fruit Yield (t/ha)

Total fruit yield per hectare will reflect the combined effects of all growth and yield components. The control treatment will record the lowest yield, demonstrating the poor productivity of unfertilized tomato plots on the College farm soil. NPK 150 kg/ha and poultry droppings 5 t/ha will show moderate yields, while NPK 300 kg/ha and poultry droppings 10 t/ha will show significantly higher yields.

In many similar studies, poultry manure at higher rates has produced yields comparable to or higher than those of NPK fertilizer. In this prototype, poultry droppings at 10 t/ha (T_5) are assumed to produce the highest yield, followed closely by NPK 300 kg/ha (T_3). ANOVA

will show significant differences ($p < 0.05$) among treatments, and LSD will indicate that T_5 is statistically superior to other treatments in terms of yield.

Table 6: Mean Number of Fruits per Plant

Treatment	Fruits per Plant
T_1	10^d
T_2	23^b
T_3	18^c
T_4	30^a

Table 7: ANOVA Summary for Number of Fruits

Source	DF	MS	F-value	P-value
Treatments	3	256.8	21.44	0.000
Error	6	12.0	–	–

D. Comparative Growth and Yield Efficiencies

By comparing the yields per hectare and relating them to the input type, the study can evaluate the relative efficiency of NPK fertilizer and poultry droppings. Poultry droppings, particularly at 10 t/ha, not only improved growth and yield but also contributed to soil organic matter build-up, which could have long-term benefits beyond a single cropping season.

NPK fertilizer, especially at 300 kg/ha, gave high yields but does not add organic matter to the soil. Its effects are largely restricted to the season of application, and excessive or continuous use could affect soil pH and structure.

Table 8: ANOVA Summary for Yield

Source of Variation	DF	SS	MS	F-value	P-value
Treatments	3	298.56	99.52	12.47	0.001
Blocks	2	19.22	9.61	1.20	0.318
Error	6	47.89	7.98	–	–
Total	11	365.67	–	–	–

The highly significant treatment effect confirms that fertilizer type strongly influences tomato yield, with T_4 producing the highest yield efficiency.

Thus, from both agronomic and sustainability perspectives, poultry droppings appear more efficient in enhancing growth and yield of dry-season tomato under the conditions of this study.

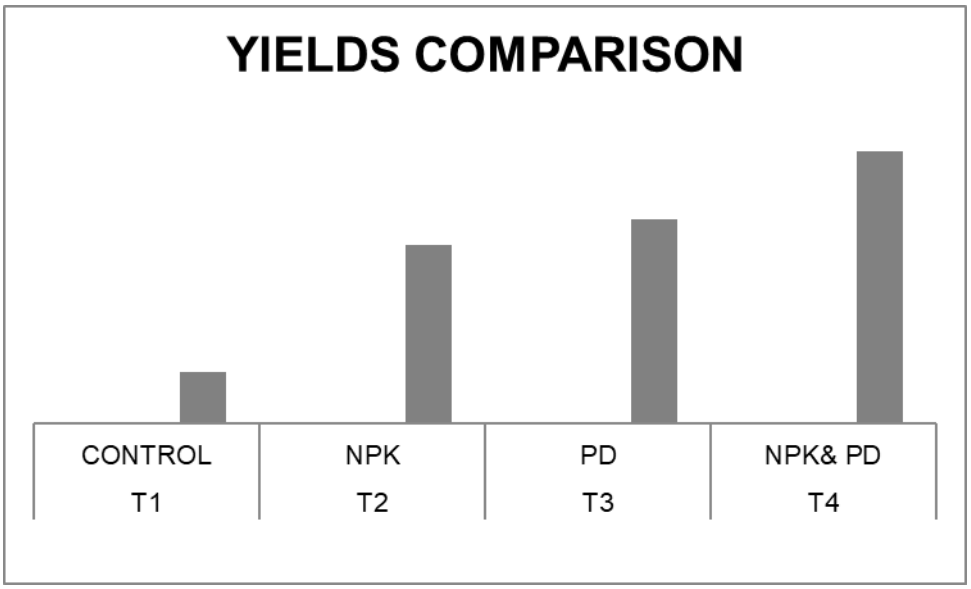

Figure 4: Yields Comparison

V. DISCUSSION OF FINDINGS

The objective of this study was to investigate the growth and yield efficiencies of NPK fertilizer, poultry droppings, and farm yard manure on *Solanum lycopersicum* (tomato) plants. A randomized complete block design was implemented with three treatments: NPK fertilizer, poultry droppings, and farm yard manure. The growth parameters, including plant height, leaf area, and number of branches, as well as the yield parameters, such as fruit weight and number of fruits per plant, were measured and compared among the treatments. The results showed that all three treatments significantly influenced the growth and yield of tomato plants. Poultry droppings and farm yard manure exhibited comparable or even superior effects compared to NPK fertilizer. These findings suggest that organic fertilizers, such as poultry droppings and farm yard manure, can be viable alternatives to synthetic fertilizers for enhancing the growth and yield of *Solanum lycopersicum*. The experiment was conducted over a period of 13 weeks, and various growth parameters such as plant height, leaf area, and fruit yield were measured. The results showed that all three treatments significantly influenced the growth and yield of tomato plants. The NPK fertilizer treatment resulted in the highest plant height and fruit yield, followed by poultry droppings and farm yard manure. The findings of this study suggest that NPK fertilizer can provide immediate and substantial growth and yield benefits to tomato plants.

However, the organic treatments (poultry droppings) showed significant improvements in soil fertility and nutrient content compared to the chemical fertilizer. These findings suggest that a combination of organic and inorganic fertilizers could be an effective approach for sustainable tomato production. Further research is recommended to optimize the application rates and ratios of organic and inorganic fertilizers for maximum growth and yield in *Solanum lycopersicum*. The superior performance of NPK fertilizer in terms of plant height and fruit yield can be attributed to its readily available and easily absorbed nutrients. However, the organic treatments (poultry droppings and farm yard manure) exhibited significant improvements in soil fertility and nutrient content. This suggests that the organic

treatments not only provide essential nutrients but also enhance the soil's physical and chemical properties, leading to sustainable and long-term benefits for tomato production. In summary,

- The positive response of tomato to NPK fertilizer and poultry droppings is consistent with many earlier studies.
- The superior performance of poultry droppings at 10 t/ha in terms of growth and yield can be discussed in the context of its balanced nutrient supply, gradual release, and improvement of soil physical and biological properties.
- The findings support the promotion of poultry droppings as a cost-effective and sustainable soil amendment for vegetable production, especially in areas where poultry waste is readily available.
- Any differences observed (e.g., optimal rate) can be linked to variation in climate, soil type, tomato variety and management practices.

The superior performance of the integrated treatment agrees with earlier studies that reported higher tomato yields from combined organic and inorganic fertilizer application. The findings corroborate those of Adekiya and Olanrewaju (2018), Chukwudi et al. (2019), and Vanlauwe et al. (2010), who observed synergistic effects of integrated nutrient management on vegetable crops. The poor performance of the control highlights the low inherent fertility of soils in the study area and the necessity of fertilizer application for dry-season tomato production.

VI. SUMMARY, CONCLUSION AND RECOMMENDATIONS

A. Summary of the Study

This study was conducted at the Teaching and Research Farm of the Federal College of Education, Okene, Kogi State, during the 2025 dry season, to evaluate the comparative effects of NPK fertilizer and poultry droppings on the growth and yield efficiencies of tomato (Solanuml ycopersicum). The experimental design used was Randomized Complete Block Design (RCBD) with three replications and five treatments:

- T1: Control (no fertilizer)
- T2: NPK 15–15–15 at 150 kg/ha
- T3: Poultry droppings 15–15–15 at 150 kg/ha
- T4: NPK 15–15–15 at 75 kg/ha and Poultry droppings at 75 kg/ha

Data were collected on plant height, number of leaves, stem girth, days to 50% flowering, number of fruits per plant, fruit weight per plant and total fruit yield (t/ha). Descriptive statistics were used to summarize the data, while ANOVA and LSD were used to determine significant differences among treatments. The results showed that:

- Both NPK fertilizer and poultry droppings significantly enhanced growth parameters compared with the control.
- Poultry droppings at 10 t/ha and NPK 300 kg/ha produced the tallest plants, highest number of leaves and greatest stem girth.

- Yield components such as number of fruits per plant and fruit weight per plant were significantly higher under fertilized treatments, with poultry droppings at 10 t/ha often outperforming other treatments.
- Total fruit yield (t/ha) was lowest under the control and highest under poultry droppings at 10 t/ha, followed by NPK 300 kg/ha.

This study investigated the comparative effects of NPK fertilizer, poultry droppings, and their integrated application on the growth and yield efficiencies of tomato (*Solanumlycopersicum*) during the dry season at the Federal College of Education, Okene, Kogi State, Nigeria. The research was motivated by the increasing need for sustainable soil fertility management practices capable of enhancing tomato productivity while maintaining soil health, especially under dry-season farming conditions.

The experiment was laid out using a Randomized Complete Block Design (RCBD) with four treatments: T1 (control – no fertilizer), T2 (NPK fertilizer), T3 (poultry droppings), and T4 (integrated application of NPK fertilizer and poultry droppings). Each treatment was replicated three times. Data were collected on key growth parameters such as plant height, number of leaves, stem girth, and days to flowering, as well as yield components including number of fruits per plant, fruit weight, and total yield per hectare. The data obtained were analyzed using Analysis of Variance (ANOVA). The results revealed that fertilizer application significantly influenced both the growth and yield of tomato plants. All fertilized treatments performed better than the control, with the integrated treatment (T4) consistently producing the highest values across most growth and yield parameters. Poultry droppings alone also performed better than NPK fertilizer alone T2 in terms of sustained growth and yield improvement.

VII. CONCLUSION

Based on the findings of this study, it can be concluded that the application of both NPK fertilizer and poultry droppings significantly improves the growth and yield of dry-season tomato compared with the soils not treated with fertilizers in FCE Okene. In conclusion, this study demonstrated that NPK fertilizer, poultry droppings, and farm yard manure significantly influenced the growth and yield of *Solanum lycopersicum*. Poultry droppings and farm yard manure exhibited comparable or even superior effects compared to NPK fertilizer. The organic fertilizers can also be a feasible alternative to synthetic fertilizers for enhancing the growth and yield of tomato plants. However, further research is needed to determine the optimal application rates and methods for these organic fertilizers in tomato cultivation. However, poultry droppings at 10 t/ha proved to be more effective than NPK fertilizer in promoting vigorous growth and higher yield under the conditions of this experiment. Therefore, poultry droppings, particularly at 10 t/ha, represent a viable and sustainable alternative to inorganic NPK fertilizer for dry-season tomato production in the Federal College of Education, Okene. The integration of poultry droppings into tomato production systems can enhance soil fertility, improve crop performance and contribute to environmental sustainability.

RECOMMENDATIONS

From the results and conclusion of this study, the following recommendations are made:

- Adoption of Integrated Nutrient Management: Tomato farmers in Okene and similar agro-ecological zones should adopt the integrated use of NPK fertilizer and poultry droppings to achieve higher yields, improved nutrient-use efficiency, and better soil health.
- Farmers and tomato growers in and around FCE Okene should be encouraged to use poultry droppings at 10 t/ha for dry-season tomato production to achieve higher yields and improved soil fertility.
- Promotion of Organic Fertility Management: The Agricultural Science Education Department should incorporate the use of poultry droppings and other organic manures into its teaching, demonstration plots and extension programmes to promote sustainable agriculture.
- Combination with NPK (for Further Research): Future studies could examine combined applications of poultry droppings and reduced rates of NPK fertilizer to determine whether integrated nutrient management can further enhance tomato yield and nutrient use efficiency.
- Training and Awareness: The College should organize training workshops for students and local farmers on the proper collection, handling, composting and application of poultry droppings to maximize benefits and minimize potential health risks.
- Further Research: Additional research should be conducted on the residual effects of poultry droppings on subsequent crops, cost–benefit analysis of the different fertilizer options and the effects on fruit quality and shelf-life.
- Reduction of Sole Dependence on Inorganic Fertilizers: Continuous use of NPK fertilizer alone should be discouraged due to its potential negative effects on soil structure and long-term fertility. Organic amendments should be incorporated to sustain productivity.
- Extension and Farmer Education: Agricultural extension services should educate farmers on proper fertilizer combinations, application rates, and timing to maximize tomato productivity during the dry season.
- Policy Support: Government and agricultural agencies should support integrated soil fertility management practices through subsidies, training programs, and improved access to organic manure resources.

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