International Journal of Agriculture and Environmental Research

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

GROWTH AND YIELD PERFORMANCE OF CUCUMBER (*CUCUMIS SATIVUS* L.) AS INFLUENCED BY MULCHING MATERIALS AND FERTILIZER TYPES

Ede, A.E.; *Ezeaku, I.E.; Uloh, E.V. and Odo S.E.

Department of Agricultural Education, Federal College of Education, Eha-Amufu, PMB 2001, Eha-Amufu, Enugu State, Nigeria.

*Corresponding Author

DOI: https://doi.org/10.51193/IJAER.2025.12202

Received: 11 Nov. 2025 / Accepted: 24 Nov. 2025 / Published: 20 Mar. 2026

ABSTRACT

This study evaluated the interactive effects of different mulching materials and fertilizer types on the growth and yield performance of cucumber (*Cucumis sativus* L.) in Eha-Amufu, Southeast Nigeria. A 3 × 3 factorial experiments arranged in a randomized complete block design (RCBD) was conducted during the 2024 cropping season. Treatments comprised three mulching materials (black polythene, sawdust, and no mulch) and three fertilizer regimes (control, poultry manure at 20 t/ha, and NPK 20-10-10 at 300 kg/ha), replicated three times. Growth parameters measured included vine length, number of leaves, and number of branches, while yield traits such as fruit length, diameter, and weight were also assessed. Results revealed that black polythene mulch significantly enhanced vine length and leaf number, especially when combined with NPK fertilizer, indicating a synergistic effect. Poultry manure outperformed other fertilizer treatments in terms of branching and fruit yield, suggesting its suitability for sustainable cucumber production. Although sawdust mulch yielded the highest number of branches, it was less effective for vine elongation. These findings underscore the benefits of integrated nutrient and mulching strategies, with specific combinations offering distinct advantages for either vegetative vigor or yield quality. The study recommends adopting black polythene mulch with NPK for rapid growth and poultry manure with sawdust mulch for improved yield under similar agroecological conditions.

Keywords: Cucumber, mulching, poultry manure, NPK fertilizer, growth and yields

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is an economically and nutritionally valuable vegetable crop grown extensively across tropical and subtropical regions. It is consumed both fresh and processed and is valued for its high-water content, essential vitamins (notably vitamins C and K), and minerals, which contribute significantly to human nutrition (Eifediyi & Remison, 2010). Despite its importance in household food supply and income generation, cucumber cultivation in many regions is constrained by poor agronomic practices. Factors such as nutrient-deficient soils, inefficient water retention, and inadequate postharvest handling techniques limit productivity (Adekiya et al., 2020).

One promising agronomic strategy to improve cucumber production is mulching—the application of protective materials on the soil surface. Mulches help conserve soil moisture, regulate soil temperature, suppress weed growth, and promote beneficial microbial activity (Teame et al., 2017). Organic mulching materials like rice straw, grass clippings, and sawdust enrich the soil with organic matter over time. In contrast, synthetic mulches such as black polyethylene are more effective in minimizing evaporation and enhancing early crop vigor (Igbal et al., 2015). However, the efficiency of mulching materials varies with crop species, soil type, and local climatic conditions.

Fertilization also plays a vital role in optimizing cucumber growth and yield. While inorganic fertilizers offer rapid nutrient availability, they may lead to environmental degradation and nutrient leaching if not applied properly (Akanbi et al., 2005). Organic fertilizers such as poultry manure and compost release nutrients more gradually, improving soil structure and long-term fertility (Ayoola & Makinde, 2008). Studies have shown that integrating both organic and inorganic fertilizers can offer synergistic benefits, enhance crop performance and sustain soil productivity (Adekiya et al., 2020).

Although numerous studies have examined the independent effects of mulching and fertilization on cucumber, their combined influence—particularly on vegetative growth, fruit yield, and postharvest attributes—remains underexplored. Therefore, this study investigates the interactive effects of different mulching materials and fertilizer types on cucumber growth and yield. The objective is to identify integrated management practices that promote sustainable production.

MATERIALS AND METHODS

Study Location

The field experiment was carried out during the 2024 cropping season at the Department of Agricultural Education's teaching and research farm, Federal College of Education, Eha-Amufu, located in Isi-Uzo Local Government Area of Enugu State, Nigeria. The geographical coordinates

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

of the site are approximately 6.659°N latitude and 7.760°E longitude. The area experiences an average annual rainfall of about 365.74 mm, with a mean temperature of 29°C. The soil at the site is characterized as sandy-clay, moderately well-drained, and low in organic matter content.

Experimental Design and Treatment Structure

A factorial experiment arranged in a 3 × 3 layout was conducted using a Randomized Complete Block Design (RCBD) with three replications. The treatments comprised three mulching options—black polyethylene mulch, sawdust mulch, and no mulch (control)—and three fertilizer treatments: no fertilizer (control), poultry manure applied at 20 tons per hectare, and NPK 20-10-10 applied at 300 kilograms per hectare. These combinations resulted in a total of nine treatment groups, replicated across 27 experimental plots.

Land Preparation and Plot Layout

Prior to planting, the field was manually cleared, ploughed, and harrowed. Each experimental plot measured 2 meters by 2 meters, with a spacing of 50 cm between plots and 50 cm between blocks. Soil beds were raised to a height of 20 cm. Mulching materials were applied at a uniform thickness of 5 cm one week before sowing. Poultry manure, which was properly decomposed, was incorporated into the soil two weeks before planting. In contrast, the NPK fertilizer was applied two weeks after planting (WAP).

Planting and Crop Management

Cucumber seeds (*Cucumis sativus* L.) were directly sown into the beds at a spacing of 50 cm × 50 cm, with two seeds per planting hole. All plots received the same crop management practices, including timely weeding and integrated pest management, to ensure uniform growing conditions across treatments.

Data Collection

Growth data were collected on vine length (cm), number of leaves per plant, and number of branches per plant. Yield-related parameters assessed included fruit length (cm), fruit diameter (cm), and fruit weight (g). Measurements were taken on two randomly selected plants from each plot.

STATISTICAL ANALYSIS

The collected data were subjected to analysis of variance (ANOVA) using GENSTAT statistical software (Release 7.22 DE, 2012). Means were compared using Fisher's Least Significant Difference (LSD) at a 5% significance level ($p \leq 0.05$). The interaction effects between mulching and fertilizer treatments were also analyzed to determine any synergistic relationships.

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

RESULTS AND DISCUSSION

Effect of Mulching and Fertilizer on Vine Length

The results presented in Table 1 show that mulching materials significantly influenced vine length from the fifth to the tenth week after planting (WAP).

Table 1: Main effects of different mulching materials on vine length of cucumber at three to ten weeks after planting

Mulching materials	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP
Black polythene	7.30	8.37	55.90	134.50	139.70	157.90	195.30	213.80
No mulch	7.19	8.58	49.41	140.30	147.50	166.00	216.5	228.30
Saw dust	6.87	7.80	48.33	87.60	94.30	112.70	142.40	161.00
LSD (0.05)	NS	NS	2.91	9.04	10.26	19.42	41.30	20.79

LSD=Least significant difference, WAP=Weeks after planting and NS=Non significant

Among the treatments, black polyethylene mulch consistently resulted in the longest vine growth, especially from 6 WAP onward. By the tenth week, vines under black polythene reached 213.80 cm, outperforming those under sawdust (161.00 cm) and the no-mulch control. These findings are in line with the results of Ihuoma and Madukwe (2017), who reported that black polyethylene mulch enhances vegetative growth in cucumber by improving soil moisture retention, regulating soil temperature, and minimizing weed interference. Similarly, Shah et al. (2022) confirmed the benefits of plastic mulch in enhancing root zone conditions and vegetative growth in cucurbit crops. In terms of fertilizer application (Table 2), NPK fertilizer significantly boosted vine length across most growth stages.

Table 2: Main effects of fertilizers on vine length of cucumber at three to ten weeks after planting

Fertilizers	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP
NPK	7.50	8.54	51.67	157.70	165.00	183.20	226.30	244.90
Poultry manure	7.30	8.73	52.33	133.30	138.10	156.50	197.00	208.90
No fertilizer	6.56	7.47	49.64	71.30	78.40	96.90	130.90	149.30
LSD (0.05)	0.50	0.22	NS	9.04	10.26	19.42	41.30	20.79

LSD=Least significant difference, WAP=Weeks after planting and NS=Non significant

At 10 WAP, the longest vines (244.90 cm) were recorded in the NPK treatment, followed by poultry manure (208.90 cm), with the control group trailing behind at 149.30 cm. The rapid growth in NPK-treated plots is likely due to the immediate availability of essential nutrients, particularly

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

nitrogen, which promotes shoot elongation and cellular expansion (Olaniyi et al., 2018). While poultry manure showed slower initial effects, it gradually improved vine length due to its slow nutrient release and contribution to soil structure, confirming the observations by Ayoola and Makinde (2012).

Interactive Effects of Mulching and Fertilizer on Vine Length

Table 3 indicates that the combination of mulch and fertilizer treatments significantly affected vine length starting from 6 WAP. The interaction between black polyethylene and NPK fertilizer produced the highest vine length (273.50 cm) at 10 WAP. Interestingly, no mulch combined with NPK also performed well, reaching 284.80 cm, which implies that the strong effect of NPK can compensate for the absence of mulch in some conditions. These results suggest a synergistic interaction between mulch and fertilizer treatments. Comparable outcomes were reported by Abbas et al. (2021), who observed increased cucumber growth and yield when plastic mulch was used in conjunction with inorganic fertilizers. Organic fertilizers combined with black mulch also showed favorable results, supporting earlier claims that integrating soil amendments with organic inputs enhances growth (Akanbi et al., 2010).

Table 3: Effects of different mulching materials and fertilizers on the vine length of cucumber at three to ten weeks after plant

Mulching materials	Fertilizers	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP
Black polythene	NPK	8.00	9.20	57.00	192.50	199.90	217.50	255.00	273.50
	Poultry manure	7.40	8.20	54.20	124.20	124.40	142.90	178.60	197.10
	No fertilizer	5.50	7.70	56.50	68.90	94.70	113.20	152.20	170.70
No mulch	NPK	7.50	8.53	48.00	174.80	182.30	200.80	266.30	284.80
	Poultry manure	7.50	9.60	52.80	185.90	193.4	211.90	246.40	264.90
	No fertilizer	6.47	7.60	56.50	60.10	66.80	85.30	116.80	135.20
Sawdust	NPK	6.90	7.90	50.00	105.90	112.80	131.30	157.5	176.30
	Poultry manure	7.00	8.40	50.00	89.90	96.40	114.60	146.10	164.60
	No fertilizer	6.70	7.10	45.00	66.90	73.60	92.10	123.60	142.10

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

LSD (0.005)	NS	NS	NS	15.65	17.77	33.64	NS	36.00

LSD=Least significant difference, WAP=Weeks after planting and NS=Non significant

Effect on Number of Leaves

As shown in Table 4, black polyethylene mulch significantly increased the number of leaves from the fifth week onward. At 10 WAP, cucumber plants mulched with black polyethylene recorded 213.80 leaves, which was substantially higher than those without mulch (96.00) or under sawdust (71.40).

Table 4: Main effects of different mulching materials on number of leaves of cucumber plant at three to ten weeks after planting

Mulching materials	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP
Black polythene	7.30	8.37	55.90	134.50	139.70	157.90	195.30	213.80
No mulch	3.33	4.44	16.67	28.33	34.00	46.67	66.60	96.00
Saw dust	3.00	4.67	10.00	16.67	21.33	41.00	54.70	71.40
LSD (0.05)	NS	NS	1.72	4.08	3.56	3.96	6.99	9.78

LSD=Least significant difference, WAP=Weeks after planting and NS=Non significant

These results affirm that mulching contributes positively to leaf development by maintaining favorable soil moisture and temperature (Shah et al., 2022). Fertilizer treatments also had a significant impact (Table 5). NPK fertilizer yielded the highest leaf number (108.40) at 10 WAP, followed by poultry manure (91.70), while the control recorded the lowest (68.00). These trends agree with previous studies which emphasized nitrogen’s role in promoting vegetative growth and leaf formation (Olaniyi et al., 2018).

Table 5: Main effects of different fertilizer on number of leaves of cucumber plant at three to ten weeks after planting

Fertilizers	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP
NPK	4.00	6.00	17.00	34.67	40.67	55.00	72.60	108.40
Poultry manure	3.00	5.00	14.67	26.00	32.00	52.56	65.30	91.70
0 t/h	2.67	3.78	9.67	15.00	19.67	39.67	53.3	68.00
LSD (0.05)	NS	0.99	1.72	4.08	3.56	3.96	6.99	9.78

LSD=Least significant difference, WAP=Weeks after planting and NS=Non significant

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Interactive Effects on Leaf Number

The combination of black polyethylene mulch and NPK fertilizer produced the highest leaf number (252.00) at 10 WAP, as indicated in Table 6. These further highlights the beneficial synergy between improved soil microclimate and readily available nutrients. These findings correspond with the study of Akanbi et al. (2010), who found that the integration of mulching and fertilization improved leaf area index and overall plant vigor in cucumbers.

Table 6: Effects of different mulching materials and fertilizers on the number of leaves of cucumber at three to ten weeks after plant

Mulching materials	Fertilizers	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP
Black polythene	NPK	4.00	7.00	20.00	56.00	63.00	81.00	96.00	252.00
	Poultry manure	3.00	6.67	16.00	23.00	30.00	48.00	63.00	86.00
	0 t/h	3.00	3.33	8.00	13.00	18.00	36.00	51.00	64.00
No mulch	NPK	4.00	6.00	21.00	31.00	37.00	56.67	66.70	101.00
	Poultry manure	3.00	3.33	19.00	39.00	45.00	53.00	79.00	118.00
	0 t/h	3.00	4.00	10.00	15.00	20.00	48.00	54.00	69.00
Sawdust	NPK	4.00	5.00	10.00	17.00	22.00	41.00	55.00	72.30
	Poultry manure	3.00	5.00	9.00	16.00	21.00	39.00	54.00	72.00
	0 t/h	2.00	4.00	11.00	17.00	21.00	39.00	55.00	72.00
LSD (0.005)		NS	NS	2.97	7.06	6.17	6.86	12.11	16.98

LSD=Least significant difference, WAP=Weeks after planting and NS=Non significant

Effect on Number of Branches

The number of branches per plant was influenced by both mulch and fertilizer treatments. According to Table 7, sawdust mulch resulted in the highest number of branches (13.00) from 5 to 10 WAP. While it was less effective in promoting vine elongation, sawdust mulch may have encouraged lateral growth by moderating soil temperatures.

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Table 7: Main effects of different mulching materials on the number of branches of cucumber plant at three to ten weeks after planting

Mulching materials	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP
Black polythene	0.33	2.11	3.00	5.00	6.67	8.07
No mulch	1.00	3.00	4.00	6.00	7.33	10.56
Saw dust	1.67	3.78	5.00	6.67	8.67	13.00
LSD (0.05)	0.53	NS	0.57	0.68	0.79	1.05

LSD=Least significant difference, WAP=Weeks after planting and NS=Non significant

Table 8 shows that poultry manure produced the highest number of branches (13.22) at 10 WAP, surpassing both the NPK and control treatments. The superior performance of poultry manure may be attributed to its improvement of soil biological activity and structure, which promotes branching (Ayoola & Makinde, 2012). Increased branching can enhance fruit production by providing more sites for flowering and fruit set.

Table 8: Main effects of different fertilizer on the number of branches of cucumber plant at three to ten weeks after planting

Fertilizers	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP
NPK	1.00	3.67	4.67	6.67	8.33	12.33
Poultry manure	1.67	3.78	5.00	7.00	9.33	13.22
0 t/h	0.33	1.44	2.33	4.00	5.00	6.67
LSD (0.05)	0.53	1.04	0.57	0.68	0.79	1.05

LSD=Least significant difference, WAP=Weeks after planting and NS= Non significant

Effect of Mulching and Fertilizer on Yield Parameters

Although the mulching treatments did not significantly affect yield traits statistically (Table 9), sawdust mulch recorded the highest fruit weight (0.56 kg), followed by black polyethylene (0.52 kg). Similar trends were observed for fruit length and diameter.

Table 9: Main effects of different mulching materials on the yield parameters of cucumber.

Mulching materials	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (kg)
Black polythene	20.40	9.15	0.52
No mulch	18.39	8.42	0.42
Sawdust	20.80	8.52	0.56
LSD (0.05)	NS	NS	NS

LSD=Least significant difference, WAP=Weeks after planting and NS= Non significant

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Fertilizer treatments, however, showed significant effects on all yield parameters (Table 10). Poultry manure led to the highest fruit length (21.87 cm), fruit diameter (9.29 cm), and fruit weight (0.61 kg), outperforming both the NPK and control treatments. These findings align with Olaniyi et al. (2018), who highlighted the potential of poultry manure in improving cucumber yield and fruit quality due to its balanced nutrient composition and contribution to soil health. The control plots recorded the lowest values, emphasizing the importance of adequate nutrient management in optimizing cucumber productivity.

Table 10: Main effects of fertilizers on the yield parameters of cucumber.

Fertilizers	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (kg)
NPK	21.22	9.15	0.53
Poultry manure	21.87	9.29	0.61
0t/h	16.50	7.66	0.36
LSD (0.05)	2.07	0.98	0.10

LSD=Least significant difference, WAP=Weeks after planting and NS= Non significant

CONCLUSION

The study clearly demonstrates that both mulching and fertilization significantly affect the vegetative and reproductive performance of cucumber Black polyethylene mulch proved to be the most effective in enhancing vegetative traits such as vine length and number of leaves, particularly when used in combination with NPK fertilizer. This combination promoted rapid early growth due to improved soil moisture retention and immediate nutrient availability.

On the other hand, poultry manure showed superior performance in terms of reproductive traits, especially fruit size, weight, and number of branches. Its slow nutrient release and enhancement of soil structure contributed to sustained growth and improved yield quality over time. Sawdust mulch also supported branching, indicating its potential in stimulating lateral growth through moderated soil temperature.

IMPLICATIONS AND RECOMMENDATIONS

The outcomes of this study highlight the importance of integrating mulching and fertilizer strategies to optimize cucumber production under field conditions. The use of black polyethylene mulch in combination with NPK fertilizer was particularly effective in promoting vigorous vegetative growth, such as extended vine length and increased leaf production. This suggests that farmers aiming for rapid canopy development and early vigor should consider this combination.

Alternatively, the application of poultry manure, especially when paired with organic mulches like sawdust, resulted in enhanced branching and superior fruit yield. This indicates that for producers

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

focused on fruit quantity and quality, integrating organic amendments with mulching offers a more sustainable and productive option.

The observed interactions between fertilizer types and mulching materials reinforce the need for context-specific management practices. Depending on production objectives—whether maximizing vegetative growth for early market access or increasing fruit yield for profitability—appropriate mulch–fertilizer combinations can be selected.

RECOMMENDATIONS

- For enhanced vegetative growth and early development, farmers should adopt black polyethylene mulch in combination with NPK fertilizer.
- To improve fruit yield and promote sustainability, poultry manure integrated with either black polyethylene or sawdust mulch is recommended.
- Extension services and agricultural stakeholders should promote integrated nutrient and mulching management systems tailored to local conditions and resource availability.
- Future research should investigate the long-term effects of these combinations on soil health, crop rotation systems, and cost-benefit analysis for broader adoption.
- Confirmation study could be carried out across years and locations.

REFERENCES

[1]. Abbas, M., Zahid, A., & Hussain, M. (2021). Effect of mulching and fertilizers on growth and yield of cucumber. *International Journal of Agricultural Sciences, 13(2), 150–158.

[2]. Adekiya, A. O., Agbede, T. M., & Ojeniyi, S. O. (2020). Effect of integrated application of poultry manure and NPK fertilizer on soil properties, growth, and yield of cucumber in a derived savanna ecology of Nigeria. International Journal of Recycling of Organic Waste in Agriculture, 9(3), 273–285. https://doi.org/10.30486/IJROWA.2020.1890494.1084

[3]. Akanbi, W. B., Togun, A. O., Adediran, J. A., & Ilupeju, E. A. O. (2005). Growth, dry matter and fruit yield components of okra under organic and inorganic sources of nutrients. American-Eurasian Journal of Sustainable Agriculture, 2(1), 1–8.

[4]. Akanbi, W. B., Togun, A. O., Adediran, J. A., & Ilupeju, E. A. O. (2010). Growth, dry matter and fruit yields components of okra under organic and inorganic sources of nutrients. American-Eurasian Journal of Sustainable Agriculture, 4(1), 1–13.

[5]. Ayoola, O. T., & Makinde, E. A. (2008). Performance of green maize and soil nutrient changes with fortified organic and inorganic fertilizers. African Journal of Plant Science, 2(3), 19–22.

[6]. Ayoola, O. T., & Makinde, E. A. (2012). Complementary organic and inorganic fertilizer application: Influence on growth and yield of cucumber (Cucumis sativus L.). Journal of

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Soil Science and Plant Nutrition, 12(3), 379–387. https://doi.org/10.4067/S0718-95162012005000024

[7]. Eifediyi, E. K., & Remison, S. U. (2010). Growth and yield of cucumber (Cucumis sativus L.) as influenced by farmyard manure and inorganic fertilizer. *Journal of Plant Breeding and Crop Science, 2(7), 216–220.

[8]. GenStat. (2012). GenStat 3.0 release 4.23 DE Discovery Edition [Computer software]. Lawes Agricultural Trust, Rothamsted Experimental Station.

[9]. Igbal, M., Khan, M. A., Khan, M. A., Hussain, M., & Rehman, H. U. (2015). Mulching enhances growth, yield and quality of cucumber (Cucumis sativus L.) under plastic tunnel. International Journal of Agronomy and Agricultural Research, 6(4), 109–117.

[10]. Ihuoma, O., & Madukwe, D. K. (2017). Growth and yield response of cucumber to drip irrigation and mulching in South Eastern Nigeria. African Journal of Agricultural Research, 12(28), 2385–2394.

[11]. Olaniyi, J. O., Akanbi, W. B., & Olaniran, O. A. (2018). Growth and fruit yield of cucumber as influenced by poultry manure and NPK fertilizer. Journal of Horticultural Science, 3(4), 45–52.

[12]. Shah, S. T., Khan, A., Khan, N., et al. (2022). Influence of plastic mulch on soil properties, cucumber growth and yield. Agricultural Water Management, 260, 107270. https://doi.org/10.1016/j.agwat.2021.107270

[13]. Teame, G., Tewolde, A., & Abrha, B. (2017). Effect of mulching on soil moisture, temperature, growth and yield of tomato (Solanum lycopersicum L.) under controlled deficit irrigation in semi-arid region of northern Ethiopia. Agricultural Water Management, 189, 81–88. https://doi.org/10.1016/j.agwat.2017.05.012

