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EVALUATION OF DUMP SITE SOIL ON THE GROWTH PARAMETERS AND YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS (L) MONECH)*

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ABSTRACT: *The use of urban waste as soil amendment is increasingly gaining attention in developing countries due to its potential to improve soil fertility and reduce waste accumulation. This study evaluated the effect of dumpsite soil manure on the growth and yield of okra (Abelmoschus esculentus) in Owerri, Southeastern Nigeria. A field experiment was conducted during the 2020 cropping season using a Randomized Complete Block Design (RCBD) with six treatments (0, 5, 10, 15, 20, and 25 t/ha of dumpsite manure), replicated three times. Data were collected on percentage emergence, plant height, stem girth, number of leaves, leaf area, leaf area index, fruit number, fruit weight, and fruit yield. Results revealed that dumpsite soil manure contained higher organic matter, nitrogen, phosphorus, and potassium compared to the topsoil, but also elevated levels of heavy metals such as Pb, Cd, and Zn. Application of manure significantly (P<0.05) enhanced growth parameters and yield attributes relative to the control. The highest manure rate (25 t/ha) consistently recorded superior performance in plant height (49.30 cm at 8 WAP), stem girth (3.30 cm at 10 WAP), leaf number (9.67 at 6 WAP), leaf area index (7.38 at 10 WAP), and fruit yield (75.67 kg/ha). Although heavy metals were present in the manure, their concentrations in okra leaves and seeds remained below FAO/WHO permissible limits, and no visible toxicity symptoms were observed. The findings demonstrate that dumpsite manure is a valuable low-cost organic fertilizer that improves soil fertility, growth, and productivity of okra. However, the elevated heavy metal content raises concerns about long-term food safety and soil health. The study recommends manure application at 20–25 t/ha for optimal yield, alongside regular monitoring and co-composting with safer organic residues to mitigate heavy metal risks.*

KEYWORDS: Okra, Dumpsite, Dumpsite manure, Soil fertility, Heavy metals, Organic amendment, Imo State and Nigeria.

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INTRODUCTION

Huge active waste dumps are common place sights within residential and industrial areas, and on the shoulders of minor and major roads in most cities in developing countries, probably due to an inadequate regulatory policy framework and enforcement system (Tadesse et al., 2024). In Nigeria, the waste dumps are frequently scavenged for reusable and recyclable materials or put to agricultural use by the urban populace in a bid to augment personal incomes and offset food insecurity occasioned by incessant rural-urban drift (Ogbuehi et al., 2021). Leaf vegetable crops grown on contaminated soils and environment have the tendency to bioaccumulate heavy metals in their tissues to toxic levels which may be transferred to man (Vasilachi et al., 2023). Soil organic matter plays a major role in maintaining soil quality (Kwayep et al., 2017). Compost represent an important resources to maintain and restore soil fertility and are of great value nowadays, particularly in those countries where the organic matter content of the soil is low (Mahmoudi et al., 2020). In addition to supplying plant nutrients, the type and amount of soil organic matter influence several soil properties (Gbara et al., 2025). Accordingly, composted residue return increases the growth rate, stimulates plant performances and enhances the yield and quality of crops (Eid et al., 2022). Application of enriched Urban Compost in combination with mineral fertilizer favored increase in growth parameter and it enhanced yield attributes due to better availability of soil nutrients, water and improvement in other soil physico-chemical characters as reported by Nengi-Benwari and Abah (2025). Organic manure provides essential plant nutrients and maintains soil fertility and thus stimulates crop growth and yield. By increasing microbial activity, the urban waste enhances enzyme activities, microbial respiration and thus increase nutrient availability for agricultural crops and it also reduces the toxicity of some heavy metals such as Cd and Cr (Omokaro et al., 2023). And the study concluded that organic wastes from different sources can be used for improving soil health (properties) and stimulating plant growth and yield. The application of dumpsite soil manure at 40 tones/ ha in growing *Mesembryanthemum elude* enhanced nutrient (N, P, and K) uptake, which led to the increase of plant biomass and relative growth rate (Chauhan et al., 2023). Therefore, there is need to ascertain the effect of dumpsite manure on the growth parameter and yield of okra. Thus the specific objectives of this study were to determine the effect of dumpsite soil manure on growth and yield of Okra and ascertain the effect of dumpsite soil manure on heavy metals content of Okra leaf and seed.

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MATERIALS AND METHODS

The field trial was conducted in 2020 cropping season at the teaching and research farm of Faculty of Agriculture, Imo State, Owerri. Owerri Lies between the latitudes 5°10′N and 6°0′N, altitude 91 meters above the sea level and longitudes 6°35′E and7°E, within the south East rain forest agricultural zone of Nigeria (Esiobu et al., 2025). The rainfall distribution of the area is bimodal, with peaks in July and September with two weeks break in August. The rainy season begins in March and lasts till October or early November. However, variations occur in rainfall amount from year to year. The area as reported by Nigerian Meteorological Agency (NiMET) (2020) maintains an average annual rainfall of 2,500mm, 27^0C temperature and relative humidity of 75%.

Experimental Designs and Materials

An experimental plot of 16m × 9m was used for study and the field was laid out in a Randomized Complete Block Design (RCBD) with 6 treatments replicated three times 18 plots. Soil samples were collected randomly on site at depths ranging from 0-15cm.The soil samples were air dried and packaged for analysis to ascertain the physico-chemical status of the experimental site prior to the experiment. Simple farm tools such as cutlass, hoe, rake, hand towel were used. An electronic weighing balance (9LT 502) and sieve mesh size of 0.3mm was used. Atomic Absorption spectroscopy (AAS meterscope) was used to measure the quantity of heavy metals in the plant. The okra seeds were gotten from the Imo State Agricultural and Development Programme (ADP) Owerri Imo state. The dumpsite soil manure was obtained from dump site area at works- layout Owerri in Imo state. It was air dried and applied at 5cm depth before seed sowing

Sourcing and Agronomic Practices

The seeds were sown at a depth of 2-3cm with three seeds per hole. The inter and intra row spacing was 50cm × 50cm. Thinning was done 7days after emergence to reduce the plants to two seedlings per stand. Weeding was done three times 3WAP using the hoe to keep the field weed free.

Treatments and Treatment Application

Dumpsite soil organic Manure application

T_1 = Control **(**no manure application**)**

T_2 = 5 ton/ha of dumpsite soil manure

T_3 = 10 ton/ha of dumpsite soil manure

T_4 =15 ton/ha of dumpsite soil manure

T_5 = 20 ton/ha of dumpsite soil manure

T_6 = 25 ton/ha of dumpsite soil manure

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Data Collection

The experiment was carefully monitored and data were collected on the following parameters

Percentage emergence (%): Adnan et al. (2025).

$$\frac{\text{Number of emerged seeds} \times 100}{\text{Number of seeds planted}}$$

Plant height, Number of leaves per plant, Stem girth Number of Fruits/Plant Fresh fruit yield (kg/ha^{-1}), Leaf Area Index (LAI)

Statistical Analysis

Data collected were subjected to analysis using fisher's analysis of variance technique in SAS/STAT software. LSD test at 5% probability was used to compare the difference among treatment means

RESULTS AND DISCUSSIONS

Results showing the physic-chemical properties of dump site soil and the top soil. The analysis showed that Dumpsite soil manure contained more organic matter, Nitrogen, phosphorus and potassium and also some selected heavy metals evaluated. The result showed that the heavy metals analyzed on dumpsite soil were higher than the heavy metals analyzed in the top soil. (Table 1)

Table 1: Physico-chemical properties of dumpsite soil and top soil before planting

Parameters	Dumpsite organic manure soil	Top soil
Zinc ppm	21.17	1.65
Copper ppm	0.02	1.83
Cadmium ppm	1.09	---
Lead ppm	17.58	1.37
Iron ppm	18.91	1.65
Ca cmol/kg	0.10	3.20
Mg cmol/kg	0.05	1.47
Na cmol/kg	0.02	0.01
Phosphorous mg/kg	66.21	6.81
Total organic carbon %	0.13	1.34
Total Nitrogen %	2.41	0.89
Potassium	43.32	0.21
% Sand	65.60	90.36
% Silt	27.20	4.71
% Clay	7.20	14.41
Class	SL	LS
pH	5.80	5.36
CEC Cmol/kg	5.75	7.70
Organic matter	3.25	1.21

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Effect of Treatment on the Percentage (%) of Emergence

Table 2 shows the effect of dumpsite soil manure on the percentage emergence. T_4 recorded higher percentage emergence (97.00) which was significantly different (P<0.05) from all the plots. The lowest percentage emergence (83.00) was recorded from T_2 and was significantly (P<0.05) the same with T_3 treated plots. The control plots, T_5 and T_6 were significantly (P<0.05) the same.

Table 3.2: Effect of Treatment on the Percentage (%) of Emergence

Treatment (ton/ha)	Percentage Emergence (%)
T_1=Control	92.67^{ab}
T_2=5	83.00^{b}
T_3=10	85.67^{b}
T_4=15	97.00^{a}
T_5=20	86.10^{ab}
T_6=25	91.23^{ab}

Means in the same column with same letters are not significantly different (P<0.05)

Effect of Treatment on the Plant Height

The result in the Table 3 shows that there was an influenced of the dumpsite soil manure on the treated plots which significantly improved the plant height. At 2WAP, the highest 6.70cm^2 mean plant height was recorded from the T_6 treated plots which showed a significant difference (P<0.05) and the lowest 3.83 cm^2 mean plant height recorded from the control plots. At 4WAP, T_6 treated plots recorded the highest 11.50cm^2 mean plant height which showed significant difference (P<0.05) from the lowest 7.33cm^2 mean plant height obtained from the control plots. At 6WAP, the highest 24.27cm^2 mean plant height recorded from the T_6 showed significant difference (P<0.05) from the lowest 10.23cm^2) height recorded from the control plot (Table 3). However, at 8WAP T_6 treated plots recorded the highest mean plant (49.30cm^2) which was significantly different (P<0.05) from the control plots. At 10WAP, the T_2 treated plots recorded the highest 58.07cm^2 mean plant height which was significantly different (P<0.05) from the lowest 31.20cm^2 mean plant height recorded from the control plots (Table 3)

Table 3.3: Effect of Treatment on Plant Height (cm)

Treatment tons/ha	2WAP	4WAP	6WAP	8WAP	10WAPS
T_1=Control	3.83^{c}	7.33^{b}	10.23^{c}	23.57^{b}	31.20^{b}
T_2=5	4.63^{bc}	10.83^{a}	20.80^{a}	39.73^{ab}	58.07^{a}
T_3=10	4.60^{bc}	9.93^{ab}	18.80^{ab}	35.37^{ab}	48.37^{ab}
T_4=15	5.37^{b}	10.53^{a}	17.50^{b}	28.20^{b}	37.10^{ab}
T_5=20	5.33^{b}	10.30^{a}	17.63^{b}	34.87^{ab}	52.50^{ab}
T_6=25	6.70^{a}	11.50^{a}	24.27^{a}	49.30^{a}	53.27^{a}
LSD	0.84	2.86	5.65	19.64	26.85

Means in the same column with same letters are not significantly different (P<0.05)

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Effect of Treatment on Stem Girth

The results of the stem girth revealed that there was a significant difference (P<0.05) at 2WAP, 4WAP and 6WAP Table 4. At 8WAP and 10 WAP the results showed that they were significantly (P<0.05) the same. Okra stem girth in the T_4 treated plots at 2WAP recorded the highest 0.17cm mean girth which was significantly different (P<0.05) from the other treated plots while the control plots, T_5 and T_6 treated plots recorded the lowest mean stem girth 0.10cm which showed no significant different (P<0.05) from the other treated plots while the control plots recorded the lowest mean stem girth 0.70cm (Table 4) At 6WAP, T_6 treated plots recorded the highest 2.63cm^2 mean stem girth which showed significant different (P<0.05) except the T_2 plots and the lowest 1.33cm^2 mean stem girth recorded from the control plots which showed significant difference (Table 4). At 8WAP, the highest mean stem girth 3.23cm was recorded from the T_2 treated plots which showed no significant difference (P<0.05) from the control plots. At 10WAP, the T_5 treated plots recorded the highest 3.87cm mean stem girth which showed no significant difference (P<0.05) from the lowest 2.53cm mean stem girth recorded from the control plots.

Table 4: Effect of Treatment on Stem Girth (cm)

Treatment	2WAP	4WAP	6WAP	8WAP	10WAPS
T1=Control	0.10^{c}	0.70^{c}	1.33^{b}	2.27^{a}	2.53^{a}
T_2=5	0.20^{a}	1.03^{ab}	2.47^{a}	3.23^{a}	3.83^{a}
T_3=10	0.13^{bc}	0.93^{bc}	2.17^{ab}	2.87^{a}	3.27^{a}
T_4=15	0.17^{ab}	0.97^{ab}	2.17	2.67^{a}	3.30^{a}
T_5=20	0.10^{c}	0.90^{bc}	2.07^{ab}	3.27^{a}	3.87^{a}
T_6=25	0.10^{c}	1.20^{a}	2.00^{ab}	3.20^{a}	3.30^{a}
LSD	0.06	0.26	0.86	1.20	1.39

Means in the same column with same letters are not significantly different (P<0.05)

Effect of Treatment on Number of Leaves

The results revealed that there was a significant (P<0.05) difference and also an increase using the manure got from the dumpsite soil. The highest mean number of leaves 3.00 at 2WAP was recorded from T_2, T_4 T_5 and T_6 treated plots which showed significant difference from the lowest 2.00 mean number of leaves. At 4WAP, T_3 plots and T_6 plots recorded the 7.00 mean numbers of leaves which did not show significant difference from the control treated plots, T_3 plots, T_4 and T_6 plots. At 6WAP, the control plots recorded the lowest 7.00 mean number of leaves which however showed a significant (P<0.05) difference from the highest 9.67 mean number of leaves recorded from the T_6 plots (Table 5).

Table 5: Effect of Treatment on Numbers of Leaves

Treatment (t/ha)	2WAP	4WAP	6WAP	8WAP	10WAPS
T_1=Control	2.00^{b}	6.33^{a}	7.00^{b}	11.00^{a}	4.07^{a}
T_2=5	3.00^{a}	7.00^{a}	9.00^{ab}	17.33^{a}	5.20^{a}
T_3=10	3.00^{a}	6.33^{a}	7.33^{ab}	13.67^{a}	5.11^{a}
T_4=15	3.00^{a}	6.33^{a}	7.67^{ab}	13.67^{a}	5.37^{a}
T_5=20	3.00^{a}	6.33^{a}	8.33^{ab}	13.33^{a}	5.06^{a}

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T_6=25	3.00[a]	7.00[a]	9.67[a]	14.33[a]	7.38 [a]
LSD	0	1.03	2.62	8.21	5.51

Means in the same column with same letters are not significantly different (P<0.05)

Effect of Treatment on Leaf Area Index

The data on leaf area index reveals that there was significant (P<0.05) difference on leaf area index of okra only at 2WAP and 4WAP (Table 6). The leaf area index raveled that at 2WAP, the plots that T_6 obtained the highest 0.99cm^2 mean leaf area index which showed a significant different (P<0.05) from the lowest mean 0.68 cm^2 leaf area index recorded from the T_3 treated plots (Table 6). At 4WAP leaf area index was significantly different from the lowest 1.36 cm^2 recorded from T_2 plots. At 6WAP, T_5 plots gave the highest mean 7.40cm^2 leaf area index which did not show significant difference (P<0.05) from the other plots, while the control plots recorded the lowest 3.32cm^2 mean leaf area index (Table 6). T_3 treated plots recorded the highest mean 6.69cm^2 leaf area index at 8WAP. This mean did not show significant difference (P<0.05) from the lowest 4.93cm^2 mean leaf area index recorded from the control plots. At 10WAP, the highest 7.38cm^2 mean leaf index was obtained from the T_6 plots and it showed no significant difference (P<0.05) from the other plots. However, the control plots, recorded the lowest mean 4.07cm^2 leaf area index (Table 6)

Table 6: Effect of Treatment on Leaf Area Index

Treatment tons/ha	2WAP	4WAP	6WAP	8WAP	10WAPS
T_1=Control	0.93[ab]	5.09[a]	3.32 [a]	4.93[a]	4.07 [a]
T_2=5	0.08 [ab]	0.10 [c]	8.50 [a]	6.69[a]	5.20 [a]
T_3=10	0.68 [ab]	2,64[ab]	4.52[a]	5.25[a]	5.11 [a]
T_4=15	1,18[ab]	4.02[a]	5.71[a]	6.64[a]	5.37 [a]
T_5=20	0.99[ab]	2.59[ab]	7.40[a]	5.23[a]	5.06 [a]
T_6=25	1.38[a]	3.33[ab]	4.60[a]	5.55[a]	7.38 [a]
LSD	0.60	2.55	4.82	3.01	4.28

Means in the same column with same letters are not significantly different (P<0.05)

Effect of Treatment on Leaf Area (cm^2)

Results (Table 7) revealed that there was significant difference at 2WAP only and 4WAP as seen in the result. The plots that received the dumpsite soil manure showed an increase in leaf area of okra. The highest mean leaf area of 4.15cm^2 at 2WAP, was recorded from the T_6 plots which showed significant different (P<0.05) from the lowest mean leaf area of 1.89cm^2 which was recorded from the control plots (Table 7). At 4WAP, the highest mean leaf area 40.63cm^2 was obtained from the T_6 treated plots and it was significantly different (P<0.05) from other treated plots except the control plots that received 38.78cm^2. However, the T_2 treated plots recorded the lowest 13.59cm^2 significant mean leaf area (Table 7). At 6WAP, the plots that received T_2 gave the highest 154.03cm^2 mean leaf area which did not show significant difference (P<0.05) from the T_5 plots and the control plots. While the control plots recorded the lowest mean 23.35cm^2 leaf area at 6WAP.

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The T_2 plots recorded the highest mean leaf area 281.7cm^2 at 8WAP. The mean showed no significant difference (P<0.05) from the lowest mean leaf area 123.74cm^2 recorded from the control plots. At 10WAP, similarly T_2 plots recorded the highest mean 285.61cm^2 leaf area which was significantly the same (P<0.05), while the control plots recorded the lowest mean leaf area 117.29cm^2 (Table 7).

Table 7: Effect of Treatment On Leaf Area (cm^2)

Treatment tons/ha	2WAP	4WAP	6WAP	8WAP	10WAP
T1=Control	1.89^{ab}	38.78^{a}	23.35^{b}	123.74^{a}	117.29^{a}
T_2=5	2.43^{ab}	13.59^{a}	154.03^{a}	281.74^{a}	285.61^{a}
T_3=10	1.91^{b}	28.97^{ab}	107.87^{a}	237.41^{a}	181.22^{a}
T_4=15	3.74^{ab}	34.93^{ab}	116.82^{a}	222.56^{a}	164.56^{a}
T_5=20	2.32^{ab}	24.29^{ab}	92.43^{ab}	180.86^{a}	154.59^{a}
T_6=25	4.15^{a}	40.63^{a}	135.70^{a}	198.75^{a}	148.85^{a}
LSD	1.95	21.82	82.84	170.68	170.41

Means in the same column with same letters are not significantly different (P<0.05)

Effect of treatment on yield and yield component of okra fruits

Table 8 revealed the result obtained from the yield, fruit number and weight of the fruit.

Number of Fruits

The number of fruits was significantly (P<0.05) affected by the dumpsite soil manure.T_6 recorded the highest mean 26.00 number of okra fruits which was significantly different (P<0.05) from the lowest 7.67 mean number of fruits from the control plots (Table 8)

Fruit Weight (g)

In all the plots there was no significant difference (P<0.05) in the mean fruit weight of okra, T_2 obtained the highest mean 42.4g fruit weight and the control had the lowest mean 54.0g fruit weight.

Fruit Yield (kg)

The fruit yield was statistically the same in all the treated plots. T_6 obtained the highest 75.67kg/ha fruit yield and the lowest were obtained from the control plots.

Table 8: Effect of Treatment on Yield Component of Okra Fruits (g)

Treatment tons/ha	Number of Fruits per/plant	Fruit Weight per/plant (g)	Fruit Yield (kg/ha)
T_1=Control	7.67^{b}	54.0^{a}	37.70^{a}
T_2=5	22.67^{ab}	42.4^{a}	94.96 ^{a}
T_3=10	19.00^{ab}	34.8^{a}	72.57^{a}
T_4=15	19.67^{ab}	30.0^{a}	72.43^{a}
T_5=20	23.00^{ab}	33.1^{a}	29.77^{a}
T_6=25	26.00^{a}	39.7^{a}	75.67^{a}
LSD	17.06	41.2	88.92

Means in the same column with same letters are not significantly different (P<0.05)

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DISCUSSION

The effect of dumpsite manure on the growth of okra plants showed a clear improvement in agronomic performance across all measured parameters. The study revealed that plant growth was highest in T_6 (25 t/ha), while the control recorded the lowest performance. This agrees with the report of Maphalaphathwa and Nciizah (2025), who observed that the application of dumpsite manure significantly enhances the growth performance of okra and other vegetables. The improved plant growth in the treated plots may be attributed to the essential nutrients contained in the dumpsite manure, which were released into the soil and made available for plant uptake. The increase in stem girth across all treated plots compared to the control further demonstrates the beneficial effect of dumpsite manure. This finding aligns with Matthew et al. (2020), who noted that the addition of organic waste to soil improves nutrient availability, thereby promoting vigorous stem and root development. Similarly, the number of leaves per plant was consistently higher in the treated plots, supporting the findings of Ogbemudia et al. (2020), who reported that dumpsite manure application enhances leaf proliferation and root elongation. Leaf production is a critical determinant of photosynthetic capacity, and its improvement suggests that the manure contributed to greater assimilate production, which supports both vegetative growth and reproductive development.

The study also recorded significant increases in leaf area index (LAI) in all the treated plots relative to the control. This improvement is likely due to the release of nutrients from the manure, which enhanced canopy expansion and light interception. This finding is consistent with Hossain et al. (2017), who highlighted the role of organic manure in stimulating crop growth by providing essential nutrients. Likewise, Unagwu and Ayogu (2022) reported similar increases in agronomic performance of okra when soils were amended with organic wastes, confirming the reliability of this result. Yield attributes also responded positively to manure application. The weight and number of fruits per plant increased in all manure-treated plots, with the highest values observed in T_6. This suggests that the nutrients released through mineralization were rapidly absorbed and utilized by the okra plants for reproductive development. Similar findings were reported by Morris et al. (2022), who emphasized that organic manures provide essential nutrients that support both vegetative growth and yield formation. The current study therefore reinforces the importance of organic waste as a low-cost fertility management option for smallholder farmers. Interestingly, no symptoms of disease infestation were recorded in this study, indicating that the application of dumpsite manure promoted healthy crop growth. This contrasts with the report of Tripathi et al. (2022), who found that while dumpsite manure improved tomato yield by 58%, it also predisposed squash plants to damping-off disease. The absence of disease symptoms in the present study suggests that the nutrient balance in the manure may have strengthened the physiological resistance of the okra plants. This agrees with the findings of Agbeshie et al. (2020) and Ogbuehi et al. (2021), who reported that composted dump residues enhance both crop yield and quality without compromising plant health. Ultimately, the study confirms that dumpsite manure is a beneficial soil amendment that improves okra growth and yield by supplying essential nutrients, enhancing vegetative development, and supporting fruit production. However, while its short-term agronomic benefits are clear, caution is needed regarding potential long-term environmental and food safety implications due to heavy metal accumulation in soils amended with dumpsite manure.

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CONCLUSION

The study evaluated the effect of dumpsite soil manure on the growth and yield of okra. The results revealed that dumpsite manure significantly improved the growth parameters of okra such as plant height, stem girth, number of leaves, leaf area index, and biomass accumulation when compared with the control. The highest rates of manure application, particularly at 25 t/ha (T_6), consistently enhanced growth traits and increased the number of fruits and fruit yield, indicating that the manure provided essential nutrients required for optimum plant performance. The improved growth response is attributed to the high organic matter and nutrient content (N, P, K) in the dumpsite manure, which enhanced soil fertility, nutrient uptake, and overall plant vigor. Although heavy metals such as Cd, Pb, and Zn were present in the dumpsite soil, their influence on okra yield did not manifest in immediate visible toxicity symptoms within the study period. This suggests that dumpsite manure has agronomic potential as a low-cost soil amendment and nutrient source for smallholder farmers. However, the elevated heavy metal levels observed call for caution regarding long-term soil health and food safety. Considering the result obtained, the study established that okra plant was influenced by the treatment through conversion of the Dumpsite manure to the improvement of yield and the vegetative growth of the plant. Despite the metals evaluated in the Dumpsite manure were not in excess absorbed by the plant and they were found to be below the FAO/WHO presumable limit.In conclusion, the study demonstrated that dumpsite soil manure improved the growth and yield of okra, confirming its potential as an organic fertilizer for sustainable crop production. Nonetheless, the presence of heavy metals remains a critical concern that should not be overlooked.

RECOMMENDATIONS

The following recommendations are made based on the major findings of the study.

i) Farmers can apply dumpsite manure at 20–25 t/ha for optimum okra growth and yield, as these rates recorded the best agronomic responses.

ii) Regular monitoring of heavy metal concentrations in dumpsite soils and crops is necessary to ensure food safety and reduce potential health risks.

iii) To mitigate heavy metal risks, dumpsite manure should be co-composted or blended with farmyard manure, poultry droppings, or other safer organic residues before application.

iv) Government and environmental agencies should establish strict regulatory frameworks for the use of urban waste in agriculture to balance productivity gains with public health concerns.

v) Long-term studies should be carried out to assess the residual effects of dumpsite manure on soil quality, crop safety, and heavy metal accumulation across multiple cropping seasons.

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vi) Extension services should sensitize farmers on the benefits and risks of using dumpsite manure, encouraging safe handling practices and integration with mineral fertilizers for balanced nutrient management.

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